2002390

Lake Calumet Cluster Site Group

SURFACE WATER SAMPLING WORK PLAN

Indian Ridge Marsh

October 2019

SURFACE WATER SAMPLING WORK PLAN

Indian Ridge Marsh

Prepared for:

Lake Calumet Cluster Site Group
c/o Susan M. Franzetti
Nijman Franzetti LLP
10 S. LaSalle Street, Suite 3600
Chicago, Illinois 60603

Prepared by:

Arcadis U.S., Inc.
200 South Michigan Avenue
Suite 2000
Chicago, IL 60604

Tel 312.575.3700
Fax 312.775.9322

Our Ref.:
30006581

Date:
October 24, 2019

.

Ellyn Gates
Ellyn Gates, PE
Staff Environmental Engineer

Paul Anderson, PhD
Principal Scientist

Jack Kratzmeyer
Jack Kratzmeyer
Certified Project Manager

CONTENTS

Acronyms and Abbreviations iii
1 Introduction 1
1.1 Work Plan Organization 1
2 Background 2
3 Surface Water collection Objectives 3
4 Sampling Design 4
4.1 Evaluation of Temporal Variability in Hydrology 4
4.2 Sample Location Selection 4
4.3 Water Quality Measurements 5
4.4 Sample Collection 5
4.4.1 Collection and Handling 5
4.4.2 Analytical Parameters 6
4.4.3 QA/QC 6
4.4.3.1 Field Duplicate Samples 6
4.4.3.2 Equipment Blank Samples 7
4.4.3.3 Matrix Spike/Matrix Spike Duplicate Samples 7
5 Schedule and Reporting 7
5.1 Schedule 7
5.2 Data Management and Surface Water Sampling Technical Memorandum 8
6 References 9

TABLES

Table 1. Constituents of Concern in Surface Water

FIGURES

Figure 1. Site Location

Figure 2. Site Vicinity

Figure 3. Proposed Surface Water Sampling Locations

APPENDICES

Appendix A Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

Appendix B Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis U.S., Inc.
BOD	Biochemical oxygen demand
COD	Chemical oxygen demand
DO	Dissolved Oxygen
GPS	Global Positioning System
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IRM	Indian Ridge Marsh
LCCS Group	Lake Calumet Cluster Site Group
MS/MSD	Matrix Spike/Matrix Spike Duplicate
OU2	Operable Unit Two
QA/QC	Quality Assurance/Quality Control
RB	Rinse blank
Site	Lake Calumet Cluster Site
SOP	Standard Operating Procedure
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
Work Plan	Surface Water Sampling Work Plan

1 INTRODUCTION

This revision to the *Surface Water Sampling Work Plan*[1] (Work Plan) was prepared by Arcadis U.S., Inc. (Arcadis) on behalf of the Lake Calumet Cluster Site Group (LCCS Group) and presents the revised scope of work for a surface water sampling investigation in Indian Ridge Marsh (IRM) to supplement the data and analysis presented in the *Groundwater Assessment Technical Memorandum* (Technical Memorandum) (Arcadis 2017).[2] The Technical Memorandum presented the results of a comprehensive groundwater investigation conducted for Operable Unit Two (OU2) at the Lake Calumet Cluster Site (the Site or LCCS). Remedial activities at the Site have been divided into two operable units. OU2 focuses specifically on groundwater entering onto and emanating from the Site. This Work Plan is designed to develop the data necessary to assess potential effects to IRM of groundwater emanating from the Site by comparing IRM surface water concentrations adjacent to the Site to relevant U.S. Environmental Protection Agency (USEPA) and State of Illinois surface water criteria and to surface water concentrations in other portions of IRM associated with other non-Site-related sources.

IRM is an undeveloped, disturbed marshland that is part of a series of open spaces in the Lake Calumet area including Big Marsh, Heron Pond, and Dead Stick Pond (Figure 1). IRM consists of two separate sections divided by 122nd Street (North Indian Ridge Marsh and South Indian Ridge Marsh) that are hydraulically connected to the Calumet River. North IRM (referred to as IRM or North IRM in the remainder of this work plan) comprises the study area for this surface water sampling investigation. The study area is approximately 110 acres in size and is bounded to the north by the former Acme Coke site, Torrance Avenue on the east, 122nd Street to the south and the Norfolk and Southern Railroad tracks on the west. Investigations have previously characterized environmental conditions within IRM, including field sampling conducted in April and May 2009 by Tetra Tech as part of a request from the U.S. Army Corps of Engineers (USACE). The USACE completed a restoration project in IRM in 2015 that involved vegetative habitat improvement, aquatic habitat improvements, hydraulic controls, and improved public access.

1.1 Work Plan Organization

This Work Plan is organized into the sections listed below.

- Section 1: Introduction – Describes the overall purpose, objective, and structure of this Work Plan.
- Section 2: Background – Provides background information on the Site.
- Section 3: Surface Water Collection Objectives – Presents the objectives of the proposed sampling effort.
- Section 4: Sampling Design – Describes the methodologies for surface water sampling and analysis.

1 Prepared by Arcadis and submitted to USEPA and the Illinois Environmental; Protection Agency (IEPA) on August 31, 2018.
2 The revisions to the scope of work are based on discussions held during a meeting between representatives of the LCCS Respondents and USEPA on July 10, 2019. The proposed enhancements to the surface water sampling investigation contained herein, were summarized in a letter dated July 30, 2019 from Leo Brausch, Project Coordinator for the Respondents to Shari Kolak, Remedial Project Manager for USEPA and copied to IEPA.

- Section 5: Schedule and Reporting – Provides the anticipated timing to perform the study and details the proposed timeline and scope of reporting.
- Section 6: References – Provides citations for references cited in this document.

2 BACKGROUND

The Site is located in a heavily industrialized area of southeastern Chicago, Illinois, southeast of Lake Calumet and approximately two miles northeast of Hegewisch, Illinois (Figure 1). The LCCS consists of four separate parcels: Album Incinerator, U.S. Drum, the Unnamed Parcel, and the Paxton Lagoons. The property is bounded to the west by Land and Lakes #3 Landfill, to the northwest by Paxton II Landfill, to the north by Paxton I Landfill, to the south by 122nd Street, and to the east by the Norfolk Southern Railroad right-of-way and IRM (Figure 2). Groundwater flow at LCCS is generally to the east-southeast (Arcadis 2017).

The Calumet area consists of wetlands that were filled for industrial development while others were left in place. IRM is an undeveloped, disturbed marshland in the Calumet area. The Illinois Department of Natural Resources (IDNR) classified IRM as a Palustrine Wetland found in an urban watershed (IDNR 2000). Historically, prior to development of the Calumet Area, these wetland areas were much more extensive and were directly connected to Lake Calumet. However, during the initial development of the wetland areas in the late 19th century, large amounts of fill were used to raise the low-lying areas for development. There have been a number of studies conducted to characterize the nature of the fill deposits in the Calumet Area including slag from nearby steel mills, dredge spoils from the channelization of the Calumet River, demolition debris, and municipal and industrial wastes (Roadcap et al. 1999; United States Geological Survey 1997). As a result of the historical fill activities, hydrologic flow patterns in the Calumet Area were altered and the previous extensive wetland areas were reduced to smaller pools, such as IRM, that are interspersed with the primarily industrial and commercial development in the area.

Surface water flow in IRM is from north to south. There is an inlet to North IRM from the former Acme Coke Plant located directly to the north of IRM (V3 2006). At one time, there were three culverts located beneath the railroad tracks immediately south of 116th Street that conveyed surface water runoff from Paxton I Landfill to IRM (Roadcap et al. 1999). The 2006 Calumet Area Hydrologic Master Plan, V3 indicated that those culverts had been abandoned. The specific date of abandonment was not reported. A main channel that runs along the western edge of IRM adjacent to the Norfolk and Southern railroad tracks. The channel is approximately 50 feet wide and extends along the entire length of the marsh. Discharge from North IRM to South IRM is controlled by an outfall structure consisting of an inlet box and attached 24-inch corrugated metal pipe culvert that runs under 122nd Street connecting the North and South IRM. Under normal and low-stage conditions, water flows from the South IRM into the Calumet River.

The estimated area within the Calumet Area watershed boundary that drains to North IRM is approximately 185 acres (V3 2006). Because North IRM is located in an urbanized watershed, surrounding properties could be influencing the surface water flow of the marsh. Additional impacts to IRM include run-off from roads, dumping, dredge material disposal, and migration of constituents from adjacent, neighboring properties.

In the Technical Memorandum (Arcadis 2017) a preliminary screening evaluation of the groundwater emanating from the Site to IRM was conducted. That evaluation concluded that impacts to IRM due to Site groundwater were likely to be minimal. However, the conclusions of the evaluation are somewhat uncertain due to the age of the samples (the surface water samples evaluated in the Technical Memorandum were collected in April 2009) and limited number of surface water analytes (metals, ammonia and hardness) included in the 2009 IRM sampling program (Tetra Tech 2009).[3]

3 SURFACE WATER COLLECTION OBJECTIVES

The objective of this investigation is to collect and analyze IRM surface water samples for constituents that may be present in the groundwater emanating from the Site into IRM. The surface water data will be used to evaluate the potential effects to IRM from constituents in such emanating groundwater. That evaluation will consist of collecting surface water samples in IRM from ten locations adjacent to its border with the Site, analyzing the samples for specific constituents of concern, and comparing any detected concentrations, to applicable and relevant Illinois Numeric and Derived Water Quality Standards (35 IAC 302.208, 302.210, 302.407, and 302.535) and USEPA Ambient Water Quality Criteria.

Additionally, as described above in Section 2, IRM itself and the area surrounding it have a long history of industrialization and disturbance creating the possibility that historic sources may have contributed constituents to IRM and that current non-Site related sources may also be contributing constituents to IRM. To account for the possibility that the contribution of these non-Site historical or current sources may by themselves lead to exceedances of relevant surface water standards and criteria, surface water will also be collected from ten IRM reference locations (Figure 3). Concentrations of any constituents in IRM surface water adjacent to the Site that exceed Illinois surface water standards or USEPA criteria will be compared to concentrations in IRM reference surface water to determine whether the exceedances are related to the Site or non-Site sources.

Constituents for IRM surface water analysis were identified by comparing the maximum concentration of each analyte detected in four quarters of on-Site groundwater sampling conducted from April 2016 through February 2017 to Illinois Numeric and Derived Water Quality Standards (35 IAC 302.208, 302.210, 302.407, and 302.535) and USEPA Ambient Water Quality Criteria (Appendix A). Based on those comparisons the constituents identified for analysis in IRM surface water are listed in Table 1.

A more detailed description of the data collection effort including the type, number, location, and physical quantity of samples and data, as well as the quality assurance and quality control (QA/QC) activities is presented below in Section 4 of this Work Plan.

[3] Prior to the Tetra Tech (2009) investigation, Harza (2001) reports surface water analysis including metals and organics (Bis (2-ethylhexyl)phthalate and Benzo(g,h,i)perylene). Only one surface water sample (SW-20) in 1999 was analyzed for a full suite of parameters: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), metals, and polychlorinated biphenyls (PCBs). The Harza (2001) results were not evaluated in the Technical Memorandum because of their age and the availability of more recent data presented in Tetra Tech (2009).

4 SAMPLING DESIGN

A summary of field activities is provided in the following sections. The activities described below will serve as a minimum proposed scope of work. Deviations from the proposed scope due to unanticipated site conditions or unavoidable health and safety concerns will be documented.

4.1 Evaluation of Temporal Variability in Hydrology

In order to evaluate the effects of temporal variability in hydrology on water quality in IRM, surface water and groundwater level data will be collected over a period of three months to assess variability and define the range of “normal” water level conditions prior to conducting surface water sampling.

- A staff gauge will be installed in IRM adjacent to the Site. Attempts will be made to locate the staff gauge centrally along Site frontage, but the final location may need to be adjusted based on access considerations. The location and elevation of the staff gauge will be surveyed following installation.
- A meteorological station with a recording rain gauge anemometer will be installed at the Site (the station may also measure barometric pressure, wind speed, and wind direction).
- A transducer and data logger will be deployed at the staff gauge for continuous monitoring of the surface water elevation in IRM.
- Transducers and data loggers will also be deployed for continuous monitoring of groundwater elevations in monitoring wells MW-04, MW-05, MW-06, and MW-07 along the east side of the Site and wells MW-01 and MW-13 at LCCS as background locations.
- Water level data will be collected for a period of three months to assess variability and define the range of normal conditions. The water levels will be collected in 30-minute intervals, and all transducers will be synchronized.
- Two rounds of surface water sampling will then be conducted under differing hydrologic conditions, but both still within the range of low to normal water-level conditions. The water samples will be analyzed for the constituents of concern identified in Table 1, plus general chemistry parameters (*i.e.,* pH, temperature, specific conductance, dissolved oxygen [DO], and turbidity) and common leachate parameters (*i.e.*, chloride, total suspended solids, total dissolved solids, alkalinity, chemical oxygen demand [COD], and biochemical oxygen demand [BOD]).

The three-month timeframe for water-level measurements may need to be adjusted to avoid winter conditions and freeze-over of IRM.

4.2 Sample Location Selection

A total of 20 surface water samples will be collected, as indicated on Figure 3. The sampling locations are divided between those adjacent to the Site and reference samples as listed below.

- LCCS/IRM border samples (10 samples adjacent to the LCCS border with IRM).
- Reference samples (10 samples located throughout other portions of IRM).

Sample locations will be accessed using a small boat or via wading if shallow water depth precludes the use of a boat. To the maximum extent practicable, access and sampling activities will proceed from downstream to upstream locations. Each targeted sample location will be located using global positioning system (GPS) equipment. An initial survey of sampling locations will be performed prior to sample collection. The appropriate Geographic Information System data layers (e.g., aerial photographs and previous sample locations) will be uploaded to the GPS unit. Once located, if the location is not suitable for sampling (e.g., due to obstruction, absence of standing water, specific safety concern, or presence of water too shallow to collect an undisturbed sample) then the sample location will be moved to a suitable location and new coordinates will be recorded; if a suitable location is not available, one or more sample locations may be eliminated. Samples will then be collected in a separate mobilization following the survey. Final sample location coordinates will be recorded and uploaded to the project database.

4.3 Water Quality Measurements

At each surface water sampling location, water quality field parameters will be measured using a YSI (or similar) water quality multi-meter. Parameters will be measured mid-depth without disturbing the sediment. The target field parameters include DO, temperature, turbidity, specific conductivity, and pH. Field parameters will be measured in accordance with the Arcadis Standard Operating Procedure (SOP) for Measuring Basic Water Quality Parameters In-Situ (Appendix B). The water quality meter will be calibrated daily prior to sampling activities in accordance with the SOP. Water depth will also be measured at each location using a weighted measuring tape and/or a sonar-based depth finder.

4.4 Sample Collection

This section describes the protocols that will be followed for field survey and surface water collection, sample processing, and laboratory analyses.

4.4.1 Collection and Handling

Surface water samples for laboratory analysis will be collected at approximate mid-depth of the water column at the locations presented on Figure 3. Sampling will be conducted in accordance with the SOP for Surface Water Sampling (Appendix B) using disposable tubing and a peristaltic pump, and/or disposable plastic bottle ware. Sample bottles for dissolved metals will be filtered using a disposable 0.45-micron in-line filter. Surface water samples will be collected mid-depth according to depth measurements taken prior to sampling. If the area is too shallow for the use of peristaltic pumps (i.e., sampling using the pump would likely generate excess suspended solids in the sample), then surface water will be collected by dipping a laboratory-supplied bottle into the water. Samples containers will then be filled directly from the laboratory-supplied bottle.

Equipment decontamination will be performed on all non-disposable and non-dedicated equipment or tools that come in contact with sample media using the procedures outlined in the SOP for Field Equipment Decontamination (Appendix B). Site personnel will perform equipment decontamination prior to removal from the site and between sample locations.

Daily activities will be recorded in a dedicated field notebook. At least one photograph will be collected of each surface water location. Field documentation will be completed in accordance with the procedures outlined in the SOP for Field Logbook Entries (Appendix B). Field documentation will be converted to electronic format and saved on a common server for access by team members and for backup.

Sample handling and packaging will be conducted in accordance with the procedures outlined in the SOP for Chain of Custody, Handling, Packing, and Shipping (Appendix B). The sample container will be labelled with the appropriate sample nomenclature and transported to the designated processing area and prepared for sample shipment. Sample deliveries will be accompanied by the chain of custody and Laboratory Analysis Request Form, which will identify the contents of the package.

4.4.2 Analytical Parameters

Target parameters were selected based on the process described in Section 3. The target parameters, and corresponding surface water criteria are included in Table 1. Samples will also be analyzed for general chemistry parameters (i.e., pH, temperature, specific conductance, dissolved oxygen, and turbidity) and common leachate parameters (i.e., chloride, total suspended solids, total dissolved solids, alkalinity, COD and BOD.

4.4.3 QA/QC

Standard QA/QC field procedures, including equipment calibration; equipment decontamination; duplicate sample collection; and sample labeling, handling, and preservation, will be implemented to support data integrity.

Field personnel will provide comprehensive documentation pertaining to all aspects of the field sampling, field analysis, and chain-of-custody. Field notes and data sheets will be reviewed by field team members for accuracy and consistency and will be retained in the project file. A summary of the chain of custody, handling, packing, and shipping of samples is presented in the SOP (Appendix B).

YSI meters will be calibrated and maintained according to manufacturer's instructions. Field personnel will be responsible for assuring that a calibration/maintenance log is maintained for each measuring device. Each log will include the name of the device, the device serial/ID number, frequency of calibration, date of calibration, results of calibration, and names of persons performing the calibration.

QA/QC samples that will be collected in the field include rinse blanks (rinse blanks) if non-dedicated equipment is used for sampling, and field duplicates. Field QA/QC samples, including field duplicate, matrix spike/matrix spike duplicate (MS/MSD), and equipment RB samples will be prepared. RB samples will be collected at a frequency of one per sampling event for non-dedicated equipment used for sampling. One field blank will be collected using a peristaltic pump and filter. Additionally, field duplicate and MS/MSD samples will be collected at a frequency of one per 20 samples for the required surface water analyses.

4.4.3.1 Field Duplicate Samples

Field duplicate samples are collected to measure the sampling and analytical variability associated with the sample results. Duplicate samples are usually collected simultaneously with or immediately after the corresponding original samples have been collected, depending on the sample type and medium. In all cases, the same sampling protocol is used to collect the original sample and the field duplicate sample. The field duplicate is analyzed for the same suite of analytical parameters as the original surface water sample. Field duplicates will be collected at a rate of one per 10 samples or one per day (whichever is less) per matrix.

4.4.3.2 Equipment Blank Samples

Equipment blank samples consist of analyte-free reagent-grade water (e.g., American Society for Testing and Materials International Type II) poured over or through the sampling equipment, collected in clean sampling bottles, and preserved as needed. Equipment blank samples may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide representative samples. When re-usable sampling equipment is deployed, equipment blank samples will be collected at rate of one per 10 primary samples or one per day (whichever is less).

4.4.3.3 Matrix Spike/Matrix Spike Duplicate Samples

An MS/MSD is a triple volume sample used by the laboratory to evaluate whether matrix effects are interfering with sample analyses and therefore compromising the accuracy or precision of those analyses. For surface water samples, MS/MSD samples will be collected at a frequency of one per 20 primary samples or one per week (whichever is greater) per each analytical method per matrix. Additional sample containers for MS/MSD sample analyses will be labelled using the sample identification as the parent sample.

5 SCHEDULE AND REPORTING

This section describes the project scheduling and reporting activities. The timeframes provided below are for completion of the activity based on weeks following USEPA approval of this Work Plan.

5.1 Schedule

Activity	Timeframe
Obtain Access to IRM from Chicago Park District	Week 3
Install Staff Gauge in IRM and Deploy Transducers and Data Loggers in Monitoring Wells	Week 4
Water Level Data Collection	Week 5 through Week 18
Surface Water Sample Location Survey	Week 18
First Round of Surface Water Sample Collection	Week 19
Receipt of Laboratory Results	Week 21
Data Validation	Week 24
Second Round of Surface Water Sample Collection	Week 31
Receipt of Laboratory Results	Week 33
Data Validation	Week 36
Surface Water Sampling Technical Memorandum	Week 44

The schedule for initiating the field work assumes timely permission for access to IRM from the City of Chicago.

5.2 Data Management and Surface Water Sampling Technical Memorandum

The data collected in this investigation will be presented in a Technical Memorandum submitted after receipt of the final validated data from this study.

6 REFERENCES

Arcadis. 2017. Technical Memorandum: Groundwater Assessment, Lake Calumet Cluster Site, Operable Unit 2, July.

Ecology and Environment, Inc. 1999. The Nature and Extent of Contamination at the Lake Calumet Cluster Site, Chicago, Cook County, Illinois, November 30.

Ecology and Environment, Inc. 2007. Groundwater Investigation Summary Report, Lake Calumet Cluster Site, Chicago, Illinois. Prepared for IEPA, Springfield, Illinois. May.

Harza. 2001. Final Comprehensive Site Investigation Report, Lake Calumet Cluster Site: Alburn, U.S. Drum and Unnamed Parcel Area, August.

Roadcap, G.S., Wenzel, M.B., Lin, S.D., Herricks, E.E., Raman, R.K., Locke, R.L., Hullinger, D.L. 1999. An Assessment of the Hydrology and Water Quality of Indian Ridge Marsh and the Potential Effects of Wetland Rehabilitation on the Diversity of Wetland Plant Communities, December.

Tetra Tech. 2008. Ecotoxicological Evaluation of Soil, Sediment, Surface Water, and Groundwater Sampling Results. Indian Ridge Marsh Ecosystem Restoration. Chicago Illinois. January.

Tetra Tech. 2009. Addendum. Ecotoxicological Evaluation. Indian Ridge Marsh, Chicago, Illinois. Prepared for USACE Chicago District. Prepared by Tetra Tech EM, Inc. July.

V3. 2006. Calumet Area Hydrologic Master Plan, Volume II, Calumet Area, City of Chicago, Cook County, Illinois. August.

TABLES

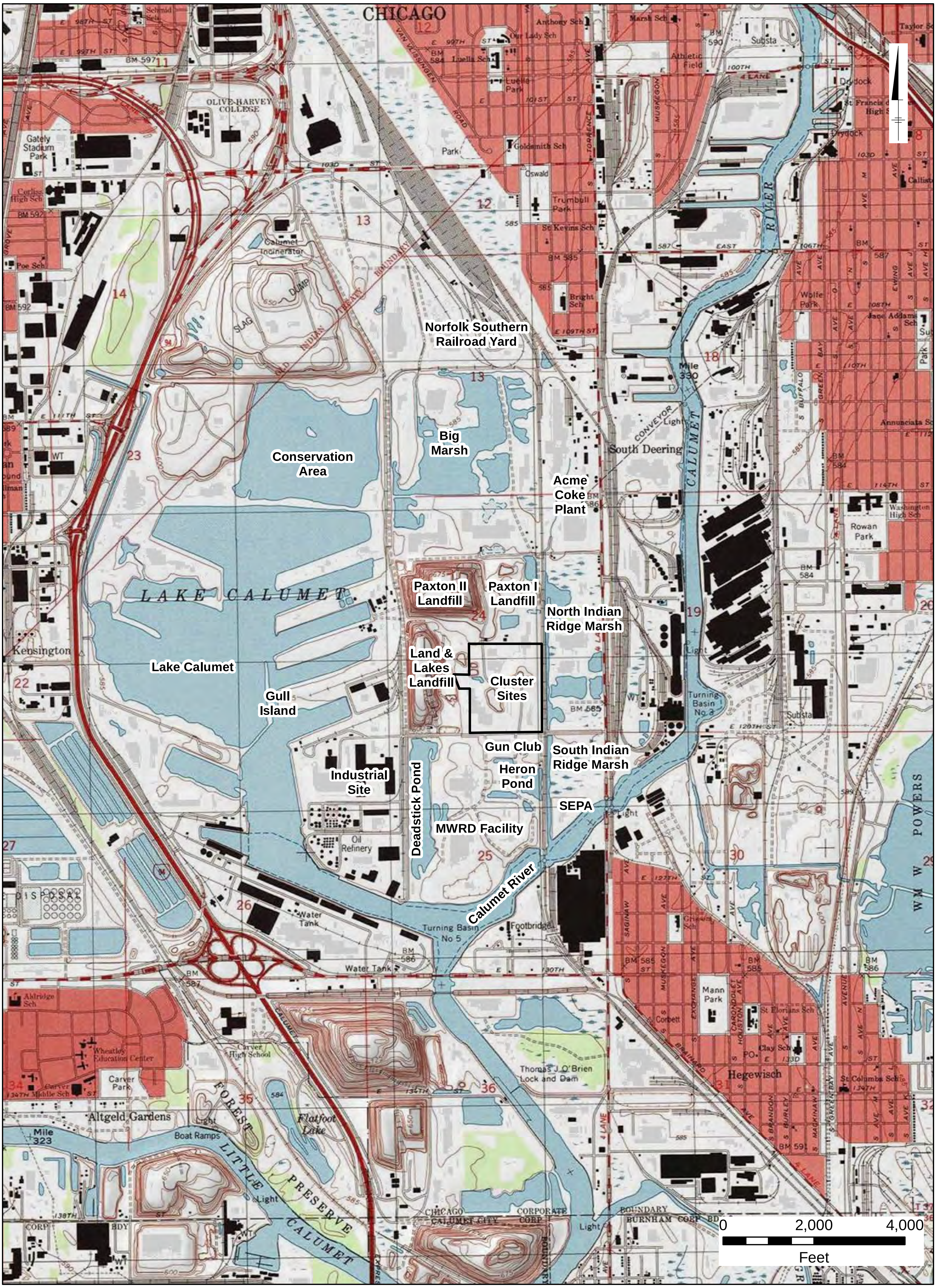
Table 1. Constituents of Concern for Surface Water
Lake Calumet Cluster Site
Chicago, IL

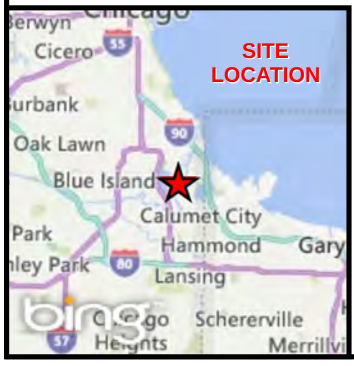
Analyte	Fraction	Units	Maximum Detect, All Wells	Lowest Screening Level	Most Conservative Screening Criteria	
					IL Water Quality Standards	USEPA Ambient Water Quality Standards
Anions						
Ammonia Nitrogen	T	mg/l	785	15	Standards for Open Waters of Lake Michigan	
Metals						
Aluminum	T	mg/l	1.9	0.087		Chronic Aquatic Life Critera
Antimony	D	mg/l	0.012	0.0056		Human Health Criteria, Water and Organism
Antimony	T	mg/l	0.019	0.0056		Human Health Criteria, Water and Organism
Arsenic	D	mg/l	0.052	0.000018		Human Health Criteria, Water and Organism
Arsenic	T	mg/l	0.058	0.000018		Human Health Criteria, Water and Organism
Barium	D	mg/l	1.2	1		Human Health Criteria, Water and Organism
Barium	T	mg/l	1.1	1		Human Health Criteria, Water and Organism
Cadmium	D	mg/l	0.0061	0.0016		Chronic Aquatic Life Critera
Chromium	D	mg/l	0.48	0.18		Chronic Aquatic Life Critera
Copper	D	mg/l	0.052	0.024	Chronic Standards for the Protection of Aquatic Organisms	
Iron	D	mg/l	41	1	Acute Standards for the Protection of Aquatic Organisms	
Iron	T	mg/l	42	1		Chronic Aquatic Life Critera
Lead	D	mg/l	0.39	0.0081		Chronic Aquatic Life Critera
Manganese	D	mg/l	2.4	0.05		Human Health Criteria, Water and Organism
Manganese	T	mg/l	2.6	0.05		Human Health Criteria, Water and Organism
Nickel	D	mg/l	0.25	0.0126	Chronic Standards for the Protection of Aquatic Organisms	
Zinc	D	mg/l	0.67	0.079	Chronic Standards for the Protection of Aquatic Organisms	
Semivolatile Organic Compounds						
2,4-Dimethylphenol	T	ug/l	470	100		Human Health Criteria, Water and Organism
Anthracene	T	ug/l	12	0.035	Standards for the Protection of Human Health	
Benzaldehyde	T	ug/l	40	14	Chronic Standards for the Protection of Aquatic Organisms	
Benzo(a)anthracene	T	ug/l	1.5	0.0012		Human Health Criteria, Water and Organism
Benzo(a)pyrene	T	ug/l	3.2	0.00012		Human Health Criteria, Water and Organism
Benzo(b)fluoranthene	T	ug/l	3.6	0.0012		Human Health Criteria, Water and Organism
Benzo(k)fluoranthene	T	ug/l	0.62	0.012		Human Health Criteria, Water and Organism
bis(2-Chloroethyl)ether	T	ug/l	1.4	0.03		Human Health Criteria, Water and Organism
bis(2-Ethylhexyl)phthalate	T	ug/l	290	0.32		Human Health Criteria, Water and Organism
Butyl benzyl phthalate	T	ug/l	1.3	0.1		Human Health Criteria, Water and Organism
Chrysene	T	ug/l	3.3	0.12		Human Health Criteria, Water and Organism
Dibenzofuran	T	ug/l	56	15	Chronic Standards for the Protection of Aquatic Organisms	
Fluoranthene	T	ug/l	12	1.8	Chronic Standards for the Protection of Aquatic Organisms	
Fluorene	T	ug/l	83	16	Chronic Standards for the Protection of Aquatic Organisms	
Indeno(1,2,3-cd)pyrene	T	ug/l	2	0.0012		Human Health Criteria, Water and Organism
Isophorone	T	ug/l	19000	34		Human Health Criteria, Water and Organism
Naphthalene	T	ug/l	3600	68	Chronic Standards for the Protection of Aquatic Organisms	
N-Nitrosodiphenylamine	T	ug/l	14.5	3.3		Human Health Criteria, Water and Organism
Pentachlorophenol	T	ug/l	1200	0.03		Human Health Criteria, Water and Organism
Phenanthrene	T	ug/l	69	3.7	Chronic Standards for the Protection of Aquatic Organisms	
Phenol	T	ug/l	4000	100	Acute Standards for the Protection of Aquatic Organisms	
Volatile Organic Compounds						
1,1-Dichloroethane	T	ug/l	3300	2000	Chronic Standards for the Protection of Aquatic Organisms	
1,2-Dichloroethane	T	ug/l	58	9.9		Human Health Criteria, Water and Organism
1,2-Dichloropropane	T	ug/l	1.7	0.9		Human Health Criteria, Water and Organism
4-Methyl-2-Pentanone	T	ug/l	24000	1400	Chronic Standards for the Protection of Aquatic Organisms	
Benzene	T	ug/l	540	0.58		Human Health Criteria, Water and Organism
Carbon Disulfide	T	ug/l	33	20	Chronic Standards for the Protection of Aquatic Organisms	
Chlorobenzene	T	ug/l	660	79	Chronic Standards for the Protection of Aquatic Organisms	
Dichloromethane	T	ug/l	6300	20		Human Health Criteria, Water and Organism
Ethylbenzene	T	ug/l	3400	14	Chronic Standards for the Protection of Aquatic Organisms	
Tetrachloroethene	T	ug/l	680	10		Human Health Criteria, Water and Organism
Toluene	T	ug/l	11000	57		Human Health Criteria, Water and Organism
Total Xylenes	T	ug/l	19000	360	Chronic Standards for the Protection of Aquatic Organisms	
Trichloroethene	T	ug/l	720	0.6		Human Health Criteria, Water and Organism
Vinyl chloride	T	ug/l	420	0.022		Human Health Criteria, Water and Organism

Notes:
T = total
D = dissolved
mg/L = milligrams per liter
ug/L = micrograms per liter

FIGURES

City: CHI User: mgress
Path: Z:\GISProjects_ENV\LCCS\MXD\2017-06\LCCS_SiteLocation_Topo_20170608.mxd





LEGEND

LAKE CALUMET CLUSTER SITE BOUNDARY

USGS TOPOGRAPHIC QUADRANGLE:
LAKE CALUMET

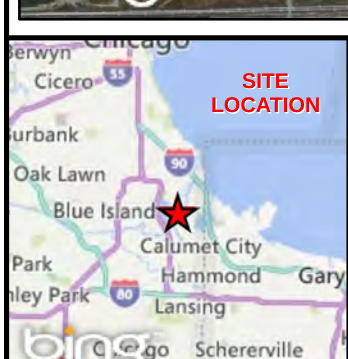
Notes:

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

SITE LOCATION

ARCADIS

FIGURE
1



LEGEND

LAKE CALUMET CLUSTER SITE BOUNDARY

Notes:
Bing Roads Base Image Source: ArcGIS Online Services, Access date: 6/6/2017, via ArcGIS v. 10.
This image is not for re-sale or distribution outside of the use of this PDF.

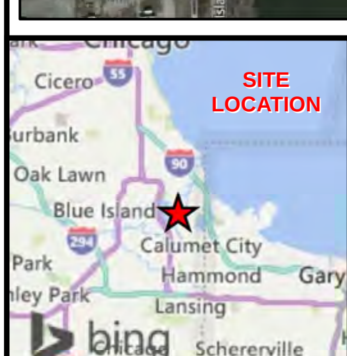
LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

SITE VICINITY

ARCADIS

FIGURE
2

City: CHI User: akens
Path: Z:\GISProjects_ENV\LCCS\MXD\2017-06\LCCS_MWLocs_PrevMWs_201807.mxd



LEGEND

- Monitoring Well Location
- Surface water and sediment sample locations collected by Ecology and Environment (1999)
- Surface water sample locations collected by Harza Engineering (2001)
- Surface water and sediment sample locations collected by MWH (2002)
- Proposed Reference Surface Water Sample Locations
- Proposed Near Site Surface Water Samples
- Surface water, sediment, and toxicity bioassay sample locations collected by Tetra Tech (2009)
- Vegetative sample locations collected by Tetra Tech (2009)
- Alburn Incinerator / US Drum
- Lake Calumet Cluster Site Boundary

Notes:
-All sampling locations are estimated based on previously published reports.
-Previous monitoring wells shown in the site boundary were destroyed.
-Bing Roads Base Image Source: ArcGIS Online Services, Access date: 8/28/2018, via ArcGIS v. 10.
This image is not for re-sale or distribution outside of the use of this PDF.

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

PROPOSED SURFACE WATER SAMPLING LOCATIONS

ARCADIS

FIGURE
1

APPENDIX A

Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Illinois Numeric Water Quality Standards (35 IAC 302.208 and 302.535): Acute Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Chronic Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Standards for the Protection of Human Health	Exceedance (Yes/No)	Standards for Open Waters of Lake Michigan	Exceedance (Yes/No)
Anions												
Ammonia Nitrogen	T	mg/l	785	--	--	--	--	--	--	--	15	Yes
Nitrate/Nitrite	T	mg/l	1.3	0.2	--	--	--	--	--	--	--	--
Nitrate-N	T	mg/l	1.3	0.1	--	--	--	--	--	--	--	--
Nitrite	T	mg/l	0.035	0.1	--	--	--	--	--	--	--	--
Sulfate	T	mg/l	1600	50	--	--	--	--	--	--	--	--
Gases												
Carbon Dioxide	T	mg/l	450	5	--	--	--	--	--	--	--	--
Methane	T	ug/l	31000	--	--	--	--	--	--	--	--	--
Nitrogen	T	mg/l	29	--	--	--	--	--	--	--	--	--
Oxygen	T	mg/l	5.9	0.5	--	--	--	--	--	--	--	--
General Chemistry												
Total Suspended Solids	T	mg/l	140	5	--	--	--	--	--	--	--	--
Metals												
Aluminum	D	mg/l	1.4	1	--	--	--	--	--	--	--	--
Aluminum	T	mg/l	1.9	0.2	--	--	--	--	--	--	--	--
Antimony	D	mg/l	0.012	0.1	--	--	--	--	--	--	--	--
Antimony	T	mg/l	0.019	0.1	--	--	--	--	--	--	--	--
Arsenic	D	mg/l	0.052	0.01	0.36	No	0.19	No	--	--	--	--
Arsenic	T	mg/l	0.058	0.01	--	--	--	--	--	--	--	--
Barium	D	mg/l	1.2	--	--	--	--	--	--	--	--	--
Barium	T	mg/l	1.1	--	5	No	--	--	--	--	--	--
Beryllium	D	mg/l	0.00085	0.02	--	--	--	--	--	--	--	--
Beryllium	T	mg/l	0.0011	0.02	--	--	--	--	--	--	--	--
Cadmium	D	mg/l	0.0061	0.01	0.030	No	0.0024	Yes	--	--	--	--
Cadmium	T	mg/l	0.008	0.01	--	--	--	--	--	--	--	--
Calcium	D	mg/l	790	--	--	--	--	--	--	--	--	--
Calcium	T	mg/l	930	--	--	--	--	--	--	--	--	--
Chromium	D	mg/l	0.48	0.01	1.3	No	0.44	Yes	--	--	--	--
Chromium	T	mg/l	0.5	0.01	--	--	--	--	--	--	--	--
Cobalt	D	mg/l	0.12	0.005	--	--	--	--	--	--	--	--
Cobalt	T	mg/l	0.12	0.005	--	--	--	--	--	--	--	--
Copper	D	mg/l	0.052	0.05	0.048	Yes	0.029	Yes	--	--	--	--
Copper	T	mg/l	0.082	0.01	--	--	--	--	--	--	--	--
Iron	D	mg/l	41	36	1	Yes	--	--	--	--	--	--
Iron	T	mg/l	42	34	--	--	--	--	--	--	--	--
Lead	D	mg/l	0.39	0.005	0.24	Yes	0.051	Yes	--	--	--	--
Lead	T	mg/l	0.71	0.005	--	--	--	--	--	--	--	--
Magnesium	D	mg/l	290	0.1	--	--	--	--	--	--	--	--
Magnesium	T	mg/l	300	--	--	--	--	--	--	--	--	--
Manganese	D	mg/l	2.4	0.05	9.5	No	4.0	No	--	--	--	--
Manganese	T	mg/l	2.6	0.05	--	--	--	--	--	--	--	--
Mercury	D	mg/l	0.00063	0.0005	0.0022	No	0.0011	No	--	--	--	--
Mercury	T	mg/l	0.0013	0.00023	--	--	--	--	0.012	No	--	--
Nickel	D	mg/l	0.25	0.01	0.21	Yes	0.013	Yes	--	--	--	--
Nickel	T	mg/l	0.27	0.01	--	--	--	--	--	--	--	--
Potassium	D	mg/l	700	--	--	--	--	--	--	--	--	--
Potassium	T	mg/l	680	--	--	--	--	--	--	--	--	--
Selenium	D	mg/l	0.039	0.05	--	--	--	--	--	--	--	--
Selenium	T	mg/l	0.023	0.05	1	No	--	--	--	--	--	--
Silver	D	mg/l	0.0016	0.025	--	--	--	--	--	--	--	--
Silver	T	mg/l	0.0026	0.025	5	No	--	--	--	--	--	--
Sodium	D	mg/l	3600	--	--	--	--	--	--	--	--	--
Sodium	T	mg/l	3600	--	--	--	--	--	--	--	--	--
Thallium	D	mg/l	--	0.05	--	--	--	--	--	--	--	--
Thallium	T	mg/l	--	0.05	--	--	--	--	--	--	--	--
Vanadium	D	mg/l	0.076	0.005	--	--	--	--	--	--	--	--
Vanadium	T	mg/l	0.081	0.005	--	--	--	--	--	--	--	--
Zinc	D	mg/l	0.67	0.02	0.30	Yes	0.079	Yes	--	--	--	--
Zinc	T	mg/l	1.1	0.02	--	--	--	--	--	--	--	--
Organochlorine Pesticides												
4,4-DDD	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
4,4-DDE	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
4,4-DDT	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Aldrin	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Alpha-BHC	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Alpha-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Beta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Delta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Dieldrin	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Endosulfan I	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Endosulfan II	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Endosulfan sulfate	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Endrin	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Endrin aldehyde	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Endrin ketone	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Gamma-BHC	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Heptachlor	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Heptachlor epoxide	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Methoxychlor	T	ug/l	--	0.4	--	--	--	--	--	--	--	--
Toxaphene	T	ug/l	--	2	--	--	--	--	--	--	--	--
trans-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Other												
Sulfide	T	mg/l	12	1	--	--	--	--	--	--	--	--
Total Organic Carbon												
Total Organic Carbon	T	mg/l	2200	--	--	--	--	--	--	--	--	--
Polychorinated Biphenyls												
Aroclor 1016	T	ug/l	--	2	--	--	--	--	--	--	--	--
Aroclor 1221	T	ug/l	0.93	2	--	--	--	--	--	--	--	--
Aroclor 1232	T	ug/l	4.45	2	--	--	--	--	--	--	--	--
Aroclor 1242	T	ug/l	8.1	2	--	--	--	--	--	--	--	--
Aroclor 1248	T	ug/l	3.5	2	--	--	--	--	--	--	--	--
Aroclor 1254	T	ug/l	2.4	2	--	--	--	--	--	--	--	--
Aroclor 1260	T	ug/l	--	2	--	--	--	--	--	--	--	--

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

					Illinois Numeric Water Quality Standards for the Chicago Area Waterway System (35 IAC 302.407)					
Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Acute Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Chronic Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Standards for the Protection of Human Health	Exceedance (Yes/No)
Anions										
Ammonia Nitrogen	T	mg/l	785	--	--	--	--	--	--	--
Nitrate/Nitrite	T	mg/l	1.3	0.2	--	--	--	--	--	--
Nitrate-N	T	mg/l	1.3	0.1	--	--	--	--	--	--
Nitrite	T	mg/l	0.035	0.1	--	--	--	--	--	--
Sulfate	T	mg/l	1600	50	--	--	--	--	--	--
Gases										
Carbon Dioxide	T	mg/l	450	5	--	--	--	--	--	--
Methane	T	ug/l	31000	--	--	--	--	--	--	--
Nitrogen	T	mg/l	29	--	--	--	--	--	--	--
Oxygen	T	mg/l	5.9	0.5	--	--	--	--	--	--
General Chemistry										
Total Suspended Solids	T	mg/l	140	5	--	--	--	--	--	--
Metals										
Aluminum	D	mg/l	1.4	1	--	--	--	--	--	--
Aluminum	T	mg/l	1.9	0.2	--	--	--	--	--	--
Antimony	D	mg/l	0.012	0.1	--	--	--	--	--	--
Antimony	T	mg/l	0.019	0.1	--	--	--	--	--	--
Arsenic	D	mg/l	0.052	0.01	0.34	No	0.15	No	--	--
Arsenic	T	mg/l	0.058	0.01	--	--	--	--	--	--
Barium	D	mg/l	1.2	--	--	--	--	--	--	--
Barium	T	mg/l	1.1	--	--	--	--	--	--	--
Beryllium	D	mg/l	0.00085	0.02	--	--	--	--	--	--
Beryllium	T	mg/l	0.0011	0.02	--	--	--	--	--	--
Cadmium	D	mg/l	0.0061	0.01	0.030	No	0.0023	Yes	--	--
Cadmium	T	mg/l	0.008	0.01	--	--	--	--	--	--
Calcium	D	mg/l	790	--	--	--	--	--	--	--
Calcium	T	mg/l	930	--	--	--	--	--	--	--
Chromium	D	mg/l	0.48	0.01	1.4	No	0.18	Yes	--	--
Chromium	T	mg/l	0.5	0.01	--	--	--	--	--	--
Cobalt	D	mg/l	0.12	0.005	--	--	--	--	--	--
Cobalt	T	mg/l	0.12	0.005	--	--	--	--	--	--
Copper	D	mg/l	0.052	0.05	0.040	Yes	0.024	Yes	--	--
Copper	T	mg/l	0.082	0.01	--	--	--	--	--	--
Iron	D	mg/l	41	36	--	--	--	--	--	--
Iron	T	mg/l	42	34	--	--	--	--	--	--
Lead	D	mg/l	0.39	0.005	0.24	Yes	0.051	Yes	--	--
Lead	T	mg/l	0.71	0.005	--	--	--	--	--	--
Magnesium	D	mg/l	290	0.1	--	--	--	--	--	--
Magnesium	T	mg/l	300	--	--	--	--	--	--	--
Manganese	D	mg/l	2.4	0.05	9.5	No	4.0	No	--	--
Manganese	T	mg/l	2.6	0.05	--	--	--	--	--	--
Mercury	D	mg/l	0.00063	0.0005	0.0012	No	0.00065	No	--	--
Mercury	T	mg/l	0.0013	0.00023	--	--	--	--	0.012	No
Nickel	D	mg/l	0.25	0.01	0.21	Yes	0.013	Yes	--	--
Nickel	T	mg/l	0.27	0.01	--	--	--	--	--	--
Potassium	D	mg/l	700	--	--	--	--	--	--	--
Potassium	T	mg/l	680	--	--	--	--	--	--	--
Selenium	D	mg/l	0.039	0.05	--	--	--	--	--	--
Selenium	T	mg/l	0.023	0.05	--	--	--	--	--	--
Silver	D	mg/l	0.0016	0.025	--	--	--	--	--	--
Silver	T	mg/l	0.0026	0.025	--	--	--	--	--	--
Sodium	D	mg/l	3600	--	--	--	--	--	--	--
Sodium	T	mg/l	3600	--	--	--	--	--	--	--
Thallium	D	mg/l	--	0.05	--	--	--	--	--	--
Thallium	T	mg/l	--	0.05	--	--	--	--	--	--
Vanadium	D	mg/l	0.076	0.005	--	--	--	--	--	--
Vanadium	T	mg/l	0.081	0.005	--	--	--	--	--	--
Zinc	D	mg/l	0.67	0.02	0.30	Yes	0.079	Yes	--	--
Zinc	T	mg/l	1.1	0.02	--	--	--	--	--	--
Organochlorine Pesticides										
4,4-DDD	T	ug/l	--	0.2	--	--	--	--	--	--
4,4-DDE	T	ug/l	--	0.2	--	--	--	--	--	--
4,4-DDT	T	ug/l	--	0.2	--	--	--	--	--	--
Aldrin	T	ug/l	--	0.2	--	--	--	--	--	--
Alpha-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Alpha-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--
Beta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Delta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Dieldrin	T	ug/l	--	0.2	--	--	--	--	--	--
Endosulfan I	T	ug/l	--	0.2	--	--	--	--	--	--
Endosulfan II	T	ug/l	--	0.2	--	--	--	--	--	--
Endosulfan sulfate	T	ug/l	--	0.2	--	--	--	--	--	--
Endrin	T	ug/l	--	0.2	--	--	--	--	--	--
Endrin aldehyde	T	ug/l	--	0.2	--	--	--	--	--	--
Endrin ketone	T	ug/l	--	0.2	--	--	--	--	--	--
Gamma-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Heptachlor	T	ug/l	--	0.2	--	--	--	--	--	--
Heptachlor epoxide	T	ug/l	--	0.2	--	--	--	--	--	--
Methoxychlor	T	ug/l	--	0.4	--	--	--	--	--	--
Toxaphene	T	ug/l	--	2	--	--	--	--	--	--
trans-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--
Other										
Sulfide	T	mg/l	12	1	--	--	--	--	--	--
Total Organic Carbon										
Total Organic Carbon	T	mg/l	2200	--	--	--	--	--	--	--
Polychorinated Biphenyls										
Aroclor 1016	T	ug/l	--	2	--	--	--	--	--	--
Aroclor 1221	T	ug/l	0.93	2	--	--	--	--	--	--
Aroclor 1232	T	ug/l	4.45	2	--	--	--	--	--	--
Aroclor 1242	T	ug/l	8.1	2	--	--	--	--	--	--
Aroclor 1248	T	ug/l	3.5	2	--	--	--	--	--	--
Aroclor 1254	T	ug/l	2.4	2	--	--	--	--	--	--
Aroclor 1260	T	ug/l	--	2	--	--	--	--	--	--

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Illinois Derived Water Quality Standards (35 IAC 302.210)					
					Acute Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Chronic Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Standards for the Protection of Human Health	Exceedance (Yes/No)
Anions										
Ammonia Nitrogen	T	mg/l	785	--	--	--	--	--	--	--
Nitrate/Nitrite	T	mg/l	1.3	0.2	--	--	--	--	--	--
Nitrate-N	T	mg/l	1.3	0.1	--	--	--	--	--	--
Nitrite	T	mg/l	0.035	0.1	--	--	--	--	--	--
Sulfate	T	mg/l	1600	50	--	--	--	--	--	--
Gases										
Carbon Dioxide	T	mg/l	450	5	--	--	--	--	--	--
Methane	T	ug/l	31000	--	--	--	--	--	--	--
Nitrogen	T	mg/l	29	--	--	--	--	--	--	--
Oxygen	T	mg/l	5.9	0.5	--	--	--	--	--	--
General Chemistry										
Total Suspended Solids	T	mg/l	140	5	--	--	--	--	--	--
Metals										
Aluminum	D	mg/l	1.4	1	--	--	--	--	--	--
Aluminum	T	mg/l	1.9	0.2	--	--	--	--	--	--
Antimony	D	mg/l	0.012	0.1	--	--	--	--	12000	No
Antimony	T	mg/l	0.019	0.1	--	--	--	--	--	--
Arsenic	D	mg/l	0.052	0.01	--	--	--	--	--	--
Arsenic	T	mg/l	0.058	0.01	--	--	--	--	--	--
Barium	D	mg/l	1.2	--	--	--	--	--	--	--
Barium	T	mg/l	1.1	--	--	--	--	--	--	--
Beryllium	D	mg/l	0.00085	0.02	--	--	--	--	--	--
Beryllium	T	mg/l	0.0011	0.02	--	--	--	--	--	--
Cadmium	D	mg/l	0.0061	0.01	--	--	--	--	--	--
Cadmium	T	mg/l	0.008	0.01	--	--	--	--	--	--
Calcium	D	mg/l	790	--	--	--	--	--	--	--
Calcium	T	mg/l	930	--	--	--	--	--	--	--
Chromium	D	mg/l	0.48	0.01	--	--	--	--	--	--
Chromium	T	mg/l	0.5	0.01	--	--	--	--	--	--
Cobalt	D	mg/l	0.12	0.005	--	--	--	--	--	--
Cobalt	T	mg/l	0.12	0.005	--	--	--	--	--	--
Copper	D	mg/l	0.052	0.05	--	--	--	--	--	--
Copper	T	mg/l	0.082	0.01	--	--	--	--	--	--
Iron	D	mg/l	41	36	--	--	--	--	--	--
Iron	T	mg/l	42	34	--	--	--	--	--	--
Lead	D	mg/l	0.39	0.005	--	--	--	--	--	--
Lead	T	mg/l	0.71	0.005	--	--	--	--	--	--
Magnesium	D	mg/l	290	0.1	--	--	--	--	--	--
Magnesium	T	mg/l	300	--	--	--	--	--	--	--
Manganese	D	mg/l	2.4	0.05	--	--	--	--	--	--
Manganese	T	mg/l	2.6	0.05	--	--	--	--	--	--
Mercury	D	mg/l	0.00063	0.0005	--	--	--	--	--	--
Mercury	T	mg/l	0.0013	0.00023	--	--	--	--	--	--
Nickel	D	mg/l	0.25	0.01	--	--	--	--	--	--
Nickel	T	mg/l	0.27	0.01	--	--	--	--	--	--
Potassium	D	mg/l	700	--	--	--	--	--	--	--
Potassium	T	mg/l	680	--	--	--	--	--	--	--
Selenium	D	mg/l	0.039	0.05	--	--	--	--	--	--
Selenium	T	mg/l	0.023	0.05	--	--	--	--	--	--
Silver	D	mg/l	0.0016	0.025	--	--	--	--	--	--
Silver	T	mg/l	0.0026	0.025	--	--	--	--	--	--
Sodium	D	mg/l	3600	--	--	--	--	--	--	--
Sodium	T	mg/l	3600	--	--	--	--	--	--	--
Thallium	D	mg/l	--	0.05	--	--	--	--	0.003	Yes
Thallium	T	mg/l	--	0.05	--	--	--	--	--	--
Vanadium	D	mg/l	0.076	0.005	--	--	--	--	--	--
Vanadium	T	mg/l	0.081	0.005	--	--	--	--	--	--
Zinc	D	mg/l	0.67	0.02	--	--	--	--	--	--
Zinc	T	mg/l	1.1	0.02	--	--	--	--	--	--
Organochlorine Pesticides										
4,4-DDD	T	ug/l	--	0.2	--	--	--	--	0.00027	Yes
4,4-DDE	T	ug/l	--	0.2	--	--	--	--	0.00019	Yes
4,4-DDT	T	ug/l	--	0.2	--	--	--	--	0.00019	Yes
Aldrin	T	ug/l	--	0.2	--	--	--	--	0.000046	Yes
Alpha-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Alpha-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--
Beta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Delta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Dieldrin	T	ug/l	--	0.2	--	--	--	--	--	--
Endosulfan I	T	ug/l	--	0.2	--	--	--	--	--	--
Endosulfan II	T	ug/l	--	0.2	--	--	--	--	--	--
Endosulfan sulfate	T	ug/l	--	0.2	--	--	--	--	--	--
Endrin	T	ug/l	--	0.2	--	--	--	--	--	--
Endrin aldehyde	T	ug/l	--	0.2	--	--	--	--	--	--
Endrin ketone	T	ug/l	--	0.2	--	--	--	--	--	--
Gamma-BHC	T	ug/l	--	0.2	--	--	--	--	--	--
Heptachlor	T	ug/l	--	0.2	--	--	--	--	--	--
Heptachlor epoxide	T	ug/l	--	0.2	--	--	--	--	--	--
Methoxychlor	T	ug/l	--	0.4	--	--	--	--	--	--
Toxaphene	T	ug/l	--	2	--	--	--	--	0.00024	Yes
trans-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--
Other										
Sulfide	T	mg/l	12	1	--	--	--	--	--	--
Total Organic Carbon										
Total Organic Carbon	T	mg/l	2200	--	--	--	--	--	--	--
Polychorinated Biphenyls										
Aroclor 1016	T	ug/l	--	2	--	--	--	--	--	--
Aroclor 1221	T	ug/l	0.93	2	--	--	--	--	--	--
Aroclor 1232	T	ug/l	4.45	2	--	--	--	--	--	--
Aroclor 1242	T	ug/l	8.1	2	--	--	--	--	--	--
Aroclor 1248	T	ug/l	3.5	2	--	--	--	--	--	--
Aroclor 1254	T	ug/l	2.4	2	--	--	--	--	--	--
Aroclor 1260	T	ug/l	--	2	--	--	--	--	--	--

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	USEPA Ambient Water Quality Criteria							
					Human Health Criteria, Water and Organism	Exceedance (Yes/No)	Human Health Criteria, Organism Only	Exceedance (Yes/No)	Acute Aquatic Life Criteria	Exceedance (Yes/No)	Chronic Aquatic Life Criteria	Exceedance (Yes/No)
Anions												
Ammonia Nitrogen	T	mg/l	785	--	--	--	--	--	--	--	--	--
Nitrate/Nitrite	T	mg/l	1.3	0.2	--	--	--	--	--	--	--	--
Nitrate-N	T	mg/l	1.3	0.1	10	No	--	--	--	--	--	--
Nitrite	T	mg/l	0.035	0.1	--	--	--	--	--	--	--	--
Sulfate	T	mg/l	1600	50	--	--	--	--	--	--	--	--
Gases												
Carbon Dioxide	T	mg/l	450	5	--	--	--	--	--	--	--	--
Methane	T	ug/l	31000	--	--	--	--	--	--	--	--	--
Nitrogen	T	mg/l	29	--	--	--	--	--	--	--	--	--
Oxygen	T	mg/l	5.9	0.5	--	--	--	--	--	--	--	--
General Chemistry												
Total Suspended Solids	T	mg/l	140	5	--	--	--	--	--	--	--	--
Metals												
Aluminum	D	mg/l	1.4	1	--	--	--	--	--	--	--	--
Aluminum	T	mg/l	1.9	0.2	--	--	--	--	0.75	Yes	0.087	Yes
Antimony	D	mg/l	0.012	0.1	0.0056	Yes	0.64	No	--	--	--	--
Antimony	T	mg/l	0.019	0.1	0.0056	Yes	0.64	No	--	--	--	--
Arsenic	D	mg/l	0.052	0.01	0.000018	Yes	0.00014	Yes	0.34	No	0.15	No
Arsenic	T	mg/l	0.058	0.01	0.000018	Yes	0.00014	Yes	--	--	--	--
Barium	D	mg/l	1.2	--	1	Yes	--	--	--	--	--	--
Barium	T	mg/l	1.1	--	1	Yes	--	--	--	--	--	--
Beryllium	D	mg/l	0.00085	0.02	--	--	--	--	--	--	--	--
Beryllium	T	mg/l	0.0011	0.02	--	--	--	--	--	--	--	--
Cadmium	D	mg/l	0.0061	0.01	--	--	--	--	0.0050	Yes	0.0016	Yes
Cadmium	T	mg/l	0.008	0.01	--	--	--	--	--	--	--	--
Calcium	D	mg/l	790	--	--	--	--	--	--	--	--	--
Calcium	T	mg/l	930	--	--	--	--	--	--	--	--	--
Chromium	D	mg/l	0.48	0.01	--	--	--	--	1.4	No	0.18	Yes
Chromium	T	mg/l	0.5	0.01	--	--	--	--	--	--	--	--
Cobalt	D	mg/l	0.12	0.005	--	--	--	--	--	--	--	--
Cobalt	T	mg/l	0.12	0.005	--	--	--	--	--	--	--	--
Copper	D	mg/l	0.052	0.05	1.3	No	--	--	--	--	--	--
Copper	T	mg/l	0.082	0.01	1.3	No	--	--	--	--	--	--
Iron	D	mg/l	41	36	--	--	--	--	--	--	--	--
Iron	T	mg/l	42	34	--	--	--	--	--	--	1	Yes
Lead	D	mg/l	0.39	0.005	--	--	--	--	0.21	Yes	0.0081	Yes
Lead	T	mg/l	0.71	0.005	--	--	--	--	--	--	--	--
Magnesium	D	mg/l	290	0.1	--	--	--	--	--	--	--	--
Magnesium	T	mg/l	300	--	--	--	--	--	--	--	--	--
Manganese	D	mg/l	2.4	0.05	0.05	Yes	0.1	Yes	--	--	--	--
Manganese	T	mg/l	2.6	0.05	0.05	Yes	0.1	Yes	--	--	--	--
Mercury	D	mg/l	0.00063	0.0005	--	--	--	--	0.0014	No	0.00077	No
Mercury	T	mg/l	0.0013	0.00023	--	--	--	--	--	--	--	--
Nickel	D	mg/l	0.25	0.01	0.61	No	4.6	No	1.2	No	0.13	Yes
Nickel	T	mg/l	0.27	0.01	0.61	No	4.6	No	--	--	--	--
Potassium	D	mg/l	700	--	--	--	--	--	--	--	--	--
Potassium	T	mg/l	680	--	--	--	--	--	--	--	--	--
Selenium	D	mg/l	0.039	0.05	0.17	No	4.2	No	--	--	--	--
Selenium	T	mg/l	0.023	0.05	0.17	No	4.2	No	--	--	--	--
Silver	D	mg/l	0.0016	0.025	--	--	--	--	0.021	No	--	--
Silver	T	mg/l	0.0026	0.025	--	--	--	--	--	--	--	--
Sodium	D	mg/l	3600	--	--	--	--	--	--	--	--	--
Sodium	T	mg/l	3600	--	--	--	--	--	--	--	--	--
Thallium	D	mg/l	--	0.05	0.00024	Yes	0.00047	Yes	--	--	--	--
Thallium	T	mg/l	--	0.05	0.00024	Yes	0.00047	Yes	--	--	--	--
Vanadium	D	mg/l	0.076	0.005	--	--	--	--	--	--	--	--
Vanadium	T	mg/l	0.081	0.005	--	--	--	--	--	--	--	--
Zinc	D	mg/l	0.67	0.02	7.4	No	26	No	0.3	Yes	0.3	Yes
Zinc	T	mg/l	1.1	0.02	7.4	No	26	No	--	--	--	--
Organochlorine Pesticides												
4,4-DDD	T	ug/l	--	0.2	0.00012	Yes	0.00012	Yes	--	--	--	--
4,4-DDE	T	ug/l	--	0.2	0.000018	Yes	0.000018	Yes	--	--	--	--
4,4-DDT	T	ug/l	--	0.2	0.00003	Yes	0.00003	Yes	1.1	No	0.001	Yes
Aldrin	T	ug/l	--	0.2	0.00000077	Yes	0.00000077	Yes	3	No	--	--
Alpha-BHC	T	ug/l	--	0.2	0.00036	Yes	0.00039	Yes	--	--	--	--
Alpha-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Beta-BHC	T	ug/l	--	0.2	0.008	Yes	0.014	Yes	--	--	--	--
Delta-BHC	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Dieldrin	T	ug/l	--	0.2	0.0000012	Yes	0.0000012	Yes	0.24	No	0.056	Yes
Endosulfan I	T	ug/l	--	0.2	20	No	30	No	0.22	No	0.056	Yes
Endosulfan II	T	ug/l	--	0.2	20	No	40	No	0.22	No	0.056	Yes
Endosulfan sulfate	T	ug/l	--	0.2	20	No	40	No	--	--	--	--
Endrin	T	ug/l	--	0.2	0.03	Yes	0.03	Yes	0.086	Yes	0.036	Yes
Endrin aldehyde	T	ug/l	--	0.2	1	No	1	No	--	--	--	--
Endrin ketone	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Gamma-BHC	T	ug/l	--	0.2	4.2	No	4.4	No	0.95	No	--	--
Heptachlor	T	ug/l	--	0.2	0.0000059	Yes	0.0000059	Yes	0.52	No	0.0038	Yes
Heptachlor epoxide	T	ug/l	--	0.2	0.000032	Yes	0.000032	Yes	0.52	No	0.0038	Yes
Methoxychlor	T	ug/l	--	0.4	0.02	Yes	0.02	Yes	--	--	0.03	Yes
Toxaphene	T	ug/l	--	2	0.0007	Yes	0.00071	Yes	0.73	Yes	0.0002	Yes
trans-chlordane	T	ug/l	--	0.2	--	--	--	--	--	--	--	--
Other												
Sulfide	T	mg/l	12	1	--	--	--	--	--	--	--	--
Total Organic Carbon												
Total Organic Carbon	T	mg/l	2200	--	--	--	--	--	--	--	--	--
Polychorinated Biphenyls												
Aroclor 1016	T	ug/l	--	2	--	--	--	--	--	--	--	--
Aroclor 1221	T	ug/l	0.93	2	--	--	--	--	--	--	--	--
Aroclor 1232	T	ug/l	4.45	2	--	--	--	--	--	--	--	--
Aroclor 1242	T	ug/l	8.1	2	--	--	--	--	--	--	--	--
Aroclor 1248	T	ug/l	3.5	2	--	--	--	--	--	--	--	--
Aroclor 1254	T	ug/l	2.4	2	--	--	--	--	--	--	--	--
Aroclor 1260	T	ug/l	--	2	--	--	--	--	--	--	--	--

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

					Illinois Numeric Water Quality Standards (35 IAC 302.208 and 302.535)							
Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Acute Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Chronic Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Standards for the Protection of Human Health	Exceedance (Yes/No)	Standards for Open Waters of Lake Michigan	Exceedance (Yes/No)
Semivolatile Organic Compounds												
1,1-Biphenyl	T	ug/l	38	410	--	--	--	--	--	--	--	--
2,2-Oxybis(1-Chloropropane)	T	ug/l	0.32	160	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	T	ug/l	--	810	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	T	ug/l	1.3	410	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	T	ug/l	--	810	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	T	ug/l	470	810	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	T	ug/l	--	1600	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	T	ug/l	--	81	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	T	ug/l	2.2	41	--	--	--	--	--	--	--	--
2-Chloronaphthalene	T	ug/l	3.1	160	--	--	--	--	--	--	--	--
2-Chlorophenol	T	ug/l	5.8	410	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	T	ug/l	--	1600	--	--	--	--	--	--	--	--
2-Methylnaphthalene	T	ug/l	360	7.3	--	--	--	--	--	--	--	--
2-Methylphenol	T	ug/l	7600	16	--	--	--	--	--	--	--	--
2-Nitroaniline	T	ug/l	--	410	--	--	--	--	--	--	--	--
2-Nitrophenol	T	ug/l	--	810	--	--	--	--	--	--	--	--
3,3-Dichlorobenzidine	T	ug/l	--	410	--	--	--	--	--	--	--	--
3-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--	--	--
4-Chloro-3-Methylphenol	T	ug/l	41	810	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--	--	--
4-Methylphenol	T	ug/l	510000	1.6	--	--	--	--	--	--	--	--
4-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--	--	--
4-Nitrophenol	T	ug/l	--	1600	--	--	--	--	--	--	--	--
Acenaphthene	T	ug/l	29	81	--	--	--	--	--	--	--	--
Acenaphthylene	T	ug/l	4.8	81	--	--	--	--	--	--	--	--
Acetophenone	T	ug/l	32	410	--	--	--	--	--	--	--	--
Anthracene	T	ug/l	12	81	--	--	--	--	--	--	--	--
Atrazine	T	ug/l	--	410	--	--	--	--	--	--	--	--
Benzaldehyde	T	ug/l	40	1600	--	--	--	--	--	--	--	--
Benzo(a)anthracene	T	ug/l	1.5	16	--	--	--	--	--	--	--	--
Benzo(a)pyrene	T	ug/l	3.2	16	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	T	ug/l	3.6	16	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	T	ug/l	--	81	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	T	ug/l	0.62	16	--	--	--	--	--	--	--	--
bis(2-Chloroethoxy)methane	T	ug/l	3.8	160	--	--	--	--	--	--	--	--
bis(2-Chloroethyl)ether	T	ug/l	1.4	160	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	T	ug/l	290	810	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	T	ug/l	1.3	160	--	--	--	--	--	--	--	--
Caprolactam	T	ug/l	2.9	810	--	--	--	--	--	--	--	--
Carbazole	T	ug/l	150	410	--	--	--	--	--	--	--	--
Chrysene	T	ug/l	3.3	41	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	T	ug/l	--	24	--	--	--	--	--	--	--	--
Dibenzofuran	T	ug/l	56	160	--	--	--	--	--	--	--	--
Diethyl phthalate	T	ug/l	32	160	--	--	--	--	--	--	--	--
Dimethyl phthalate	T	ug/l	--	160	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	T	ug/l	5.5	410	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	T	ug/l	--	810	--	--	--	--	--	--	--	--
Fluoranthene	T	ug/l	12	81	--	--	--	--	--	--	--	--
Fluorene	T	ug/l	83	81	--	--	--	--	--	--	--	--
Hexachloro-1,3-butadiene	T	ug/l	--	410	--	--	--	--	--	--	--	--
Hexachlorobenzene	T	ug/l	--	41	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	T	ug/l	--	1600	--	--	--	--	--	--	--	--
Hexachloroethane	T	ug/l	--	410	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	T	ug/l	2	16	--	--	--	--	--	--	--	--
Isophorone	T	ug/l	19000	17	--	--	--	--	--	--	--	--
Naphthalene	T	ug/l	3600	3.6	--	--	--	--	--	--	--	--
Nitrobenzene	T	ug/l	--	81	--	--	--	--	--	--	--	--
N-Nitrosodi-n-propylamine	T	ug/l	--	41	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	T	ug/l	14.5	81	--	--	--	--	--	--	--	--
p-Chloroaniline	T	ug/l	13	810	--	--	--	--	--	--	--	--
Pentachlorophenol	T	ug/l	1200	170	--	--	--	--	--	--	--	--
Phenanthrene	T	ug/l	69	81	--	--	--	--	--	--	--	--
Phenol	T	ug/l	4000	42	100	Yes	--	--	--	--	--	--
Pyrene	T	ug/l	10	81	--	--	--	--	--	--	--	--
Volatile Organic Compounds												
1,1,1-Trichloroethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,1,2-trichloro-1,2,2-trifluoroethan	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,1-Dichloroethane	T	ug/l	3300	20	--	--	--	--	--	--	--	--
1,1-Dichloroethene	T	ug/l	10	20	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	T	ug/l	--	100	--	--	--	--	--	--	--	--
1,2-Dibromoethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	T	ug/l	24	20	--	--	--	--	--	--	--	--
1,2-Dichloroethane	T	ug/l	58	20	--	--	--	--	--	--	--	--
1,2-Dichloropropane	T	ug/l	1.7	20	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	T	ug/l	5.6	20	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	T	ug/l	23	20	--	--	--	--	--	--	--	--
2-Butanone (MEK)	T	ug/l	2700	100	--	--	--	--	--	--	--	--
4-Methyl-2-Pentanone	T	ug/l	24000	100	--	--	--	--	--	--	--	--
Acetone	T	ug/l	4800	100	--	--	--	--	--	--	--	--
Benzene	T	ug/l	540	0.5	4200	No	860	No	310	Yes	--	--
Bromodichloromethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
Bromoform	T	ug/l	--	20	--	--	--	--	--	--	--	--
Bromomethane	T	ug/l	--	40	--	--	--	--	--	--	--	--
Carbon Disulfide	T	ug/l	33	40	--	--	--	--	--	--	--	--
Carbon Tetrachloride	T	ug/l	--	20	--	--	--	--	--	--	--	--
CFC-11	T	ug/l	--	20	--	--	--	--	--	--	--	--
CFC-12	T	ug/l	--	40	--	--	--	--	--	--	--	--
Chlorobenzene	T	ug/l	660	20	--	--	--	--	--	--	--	--
Chlorodibromomethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
Chloroethane	T	ug/l	26	20	--	--	--	--	--	--	--	--
Chloroform	T	ug/l	0.65	20	--	--	--	--	--	--	--	--
Chloromethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	T	ug/l	1100	20	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--	--	--
Cyclohexane	T	ug/l	110	20	--	--	--	--	--	--	--	--
Dichloromethane	T	ug/l	6300	100	--	--	--	--	--	--	--	--
Ethylbenzene	T	ug/l	3400	0.5	150	Yes	14	Yes	--	--	--	--
Isopropylbenzene	T	ug/l	110	20	--	--	--	--	--	--	--	--
Methyl Acetate	T	ug/l	110	100	--	--	--	--	--	--	--	--
Methyl N-Butyl Ketone (2-Hexano	T	ug/l	--	100	--	--	--	--	--	--	--	--
Methylcyclohexane	T	ug/l	170	20	--	--	--	--	--	--	--	--
Methyl-tert-butylether	T	ug/l	--	20	--	--	--	--	--	--	--	--
Styrene (Monomer)	T	ug/l	120	20	--	--	--	--	--	--	--	--
Tetrachloroethene	T	ug/l	680	20	--	--	--	--	--	--	--	--
Toluene	T	ug/l	11000	0.5	2000	Yes	600	Yes	--	--	--	--
Total Xylenes	T	ug/l	19000	1	920	Yes	360	Yes	--	--	--	--
trans-1,2-Dichloroethene	T	ug/l	23	20	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--	--	--
Trichloroethene	T	ug/l	720	10	--	--	--	--	--	--	--	--
Vinyl chloride	T	ug/l	420	10	--	--	--	--	--	--	--	--

Notes:

[1] Maximum detect was used to screen criteria if available. If maximum detect not available (i.e., constituent not detected in any samples), the maximum non-detect was used.

-- = not available or not applicable

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

					Illinois Numeric Water Quality Standards for the Chicago Area Waterway System (35 IAC 302.407)					
Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Acute Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Chronic Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Standards for the Protection of Human Health	Exceedance (Yes/No)
Semivolatile Organic Compounds										
1,1-Biphenyl	T	ug/l	38	410	--	--	--	--	--	--
2,2-Oxybis(1-Chloropropane)	T	ug/l	0.32	160	--	--	--	--	--	--
2,4,5-Trichlorophenol	T	ug/l	--	810	--	--	--	--	--	--
2,4,6-Trichlorophenol	T	ug/l	1.3	410	--	--	--	--	--	--
2,4-Dichlorophenol	T	ug/l	--	810	--	--	--	--	--	--
2,4-Dimethylphenol	T	ug/l	470	810	--	--	--	--	--	--
2,4-Dinitrophenol	T	ug/l	--	1600	--	--	--	--	--	--
2,4-Dinitrotoluene	T	ug/l	--	81	--	--	--	--	--	--
2,6-Dinitrotoluene	T	ug/l	2.2	41	--	--	--	--	--	--
2-Chloronaphthalene	T	ug/l	3.1	160	--	--	--	--	--	--
2-Chlorophenol	T	ug/l	5.8	410	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	T	ug/l	--	1600	--	--	--	--	--	--
2-Methylnaphthalene	T	ug/l	360	7.3	--	--	--	--	--	--
2-Methylphenol	T	ug/l	7600	16	--	--	--	--	--	--
2-Nitroaniline	T	ug/l	--	410	--	--	--	--	--	--
2-Nitrophenol	T	ug/l	--	810	--	--	--	--	--	--
3,3-Dichlorobenzidine	T	ug/l	--	410	--	--	--	--	--	--
3-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--
4-Bromophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--
4-Chloro-3-Methylphenol	T	ug/l	41	810	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--
4-Methylphenol	T	ug/l	510000	1.6	--	--	--	--	--	--
4-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--
4-Nitrophenol	T	ug/l	--	1600	--	--	--	--	--	--
Acenaphthene	T	ug/l	29	81	--	--	--	--	--	--
Acenaphthylene	T	ug/l	4.8	81	--	--	--	--	--	--
Acetophenone	T	ug/l	32	410	--	--	--	--	--	--
Anthracene	T	ug/l	12	81	--	--	--	--	--	--
Atrazine	T	ug/l	--	410	--	--	--	--	--	--
Benzaldehyde	T	ug/l	40	1600	--	--	--	--	--	--
Benzo(a)anthracene	T	ug/l	1.5	16	--	--	--	--	--	--
Benzo(a)pyrene	T	ug/l	3.2	16	--	--	--	--	--	--
Benzo(b)fluoranthene	T	ug/l	3.6	16	--	--	--	--	--	--
Benzo(g,h,i)perylene	T	ug/l	--	81	--	--	--	--	--	--
Benzo(k)fluoranthene	T	ug/l	0.62	16	--	--	--	--	--	--
bis(2-Chloroethoxy)methane	T	ug/l	3.8	160	--	--	--	--	--	--
bis(2-Chloroethyl)ether	T	ug/l	1.4	160	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	T	ug/l	290	810	--	--	--	--	--	--
Butyl benzyl phthalate	T	ug/l	1.3	160	--	--	--	--	--	--
Caprolactam	T	ug/l	2.9	810	--	--	--	--	--	--
Carbazole	T	ug/l	150	410	--	--	--	--	--	--
Chrysene	T	ug/l	3.3	41	--	--	--	--	--	--
Dibenzo(a,h)anthracene	T	ug/l	--	24	--	--	--	--	--	--
Dibenzofuran	T	ug/l	56	160	--	--	--	--	--	--
Diethyl phthalate	T	ug/l	32	160	--	--	--	--	--	--
Dimethyl phthalate	T	ug/l	--	160	--	--	--	--	--	--
Di-n-butyl phthalate	T	ug/l	5.5	410	--	--	--	--	--	--
Di-n-octyl phthalate	T	ug/l	--	810	--	--	--	--	--	--
Fluoranthene	T	ug/l	12	81	--	--	--	--	--	--
Fluorene	T	ug/l	83	81	--	--	--	--	--	--
Hexachloro-1,3-butadiene	T	ug/l	--	410	--	--	--	--	--	--
Hexachlorobenzene	T	ug/l	--	41	--	--	--	--	--	--
Hexachlorocyclopentadiene	T	ug/l	--	1600	--	--	--	--	--	--
Hexachloroethane	T	ug/l	--	410	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	T	ug/l	2	16	--	--	--	--	--	--
Isophorone	T	ug/l	19000	17	--	--	--	--	--	--
Naphthalene	T	ug/l	3600	3.6	--	--	--	--	--	--
Nitrobenzene	T	ug/l	--	81	--	--	--	--	--	--
N-Nitrosodi-n-propylamine	T	ug/l	--	41	--	--	--	--	--	--
N-Nitrosodiphenylamine	T	ug/l	14.5	81	--	--	--	--	--	--
p-Chloroaniline	T	ug/l	13	810	--	--	--	--	--	--
Pentachlorophenol	T	ug/l	1200	170	--	--	--	--	--	--
Phenanthrene	T	ug/l	69	81	--	--	--	--	--	--
Phenol	T	ug/l	4000	42	--	--	--	--	860000	No
Pyrene	T	ug/l	10	81	--	--	--	--	--	--
Volatile Organic Compounds										
1,1,1-Trichloroethane	T	ug/l	--	20	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	T	ug/l	--	20	--	--	--	--	--	--
1,1,2-trichloro-1,2,2-trifluoroethan	T	ug/l	--	20	--	--	--	--	--	--
1,1,2-Trichloroethane	T	ug/l	--	20	--	--	--	--	--	--
1,1-Dichloroethane	T	ug/l	3300	20	--	--	--	--	--	--
1,1-Dichloroethene	T	ug/l	10	20	--	--	--	--	--	--
1,2,4-Trichlorobenzene	T	ug/l	--	20	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	T	ug/l	--	100	--	--	--	--	--	--
1,2-Dibromoethane	T	ug/l	--	20	--	--	--	--	--	--
1,2-Dichlorobenzene	T	ug/l	24	20	--	--	--	--	--	--
1,2-Dichloroethane	T	ug/l	58	20	--	--	--	--	--	--
1,2-Dichloropropane	T	ug/l	1.7	20	--	--	--	--	--	--
1,3-Dichlorobenzene	T	ug/l	5.6	20	--	--	--	--	--	--
1,4-Dichlorobenzene	T	ug/l	23	20	--	--	--	--	--	--
2-Butanone (MEK)	T	ug/l	2700	100	--	--	--	--	--	--
4-Methyl-2-Pentanone	T	ug/l	24000	100	--	--	--	--	--	--
Acetone	T	ug/l	4800	100	--	--	--	--	--	--
Benzene	T	ug/l	540	0.5	4200	No	860	No	310	Yes
Bromodichloromethane	T	ug/l	--	20	--	--	--	--	--	--
Bromoform	T	ug/l	--	20	--	--	--	--	--	--
Bromomethane	T	ug/l	--	40	--	--	--	--	--	--
Carbon Disulfide	T	ug/l	33	40	--	--	--	--	--	--
Carbon Tetrachloride	T	ug/l	--	20	--	--	--	--	--	--
CFC-11	T	ug/l	--	20	--	--	--	--	--	--
CFC-12	T	ug/l	--	40	--	--	--	--	--	--
Chlorobenzene	T	ug/l	660	20	--	--	--	--	--	--
Chlorodibromomethane	T	ug/l	--	20	--	--	--	--	--	--
Chloroethane	T	ug/l	26	20	--	--	--	--	--	--
Chloroform	T	ug/l	0.65	20	--	--	--	--	--	--
Chloromethane	T	ug/l	--	20	--	--	--	--	--	--
cis-1,2-Dichloroethene	T	ug/l	1100	20	--	--	--	--	--	--
cis-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--
Cyclohexane	T	ug/l	110	20	--	--	--	--	--	--
Dichloromethane	T	ug/l	6300	100	--	--	--	--	--	--
Ethylbenzene	T	ug/l	3400	0.5	150	Yes	14	Yes	--	--
Isopropylbenzene	T	ug/l	110	20	--	--	--	--	--	--
Methyl Acetate	T	ug/l	110	100	--	--	--	--	--	--
Methyl N-Butyl Ketone (2-Hexano	T	ug/l	--	100	--	--	--	--	--	--
Methylcyclohexane	T	ug/l	170	20	--	--	--	--	--	--
Methyl-tert-butylether	T	ug/l	--	20	--	--	--	--	--	--
Styrene (Monomer)	T	ug/l	120	20	--	--	--	--	--	--
Tetrachloroethene	T	ug/l	680	20	--	--	--	--	--	--
Toluene	T	ug/l	11000	0.5	2000	Yes	600	Yes	--	--
Total Xylenes	T	ug/l	19000	1	920	Yes	360	Yes	--	--
trans-1,2-Dichloroethene	T	ug/l	23	20	--	--	--	--	--	--
trans-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--
Trichloroethene	T	ug/l	720	10	--	--	--	--	--	--
Vinyl chloride	T	ug/l	420	10	--	--	--	--	--	--

Notes:

[1] Maximum detect was used to screen criteria if available. If maximum detect not available (i.e., constituent not detected in any samples), the maximum non-detect was used.

-- = not available or not applicable

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

					Illinois Derived Water Quality Standards (35 IAC 302.210)					
Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Acute Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Chronic Standards for the Protection of Aquatic Organisms	Exceedance (Yes/No)	Standards for the Protection of Human Health	Exceedance (Yes/No)
Semivolatile Organic Compounds										
1,1-Biphenyl	T	ug/l	38	410	--	--	--	--	--	--
2,2-Oxybis(1-Chloropropane)	T	ug/l	0.32	160	--	--	--	--	--	--
2,4,5-Trichlorophenol	T	ug/l	--	810	--	--	--	--	0.0032	Yes
2,4,6-Trichlorophenol	T	ug/l	1.3	410	--	--	--	--	2.1	No
2,4-Dichlorophenol	T	ug/l	--	810	--	--	--	--	--	--
2,4-Dimethylphenol	T	ug/l	470	810	--	--	--	--	--	--
2,4-Dinitrophenol	T	ug/l	--	1600	--	--	--	--	--	--
2,4-Dinitrotoluene	T	ug/l	--	81	--	--	--	--	--	--
2,6-Dinitrotoluene	T	ug/l	2.2	41	--	--	--	--	--	--
2-Chloronaphthalene	T	ug/l	3.1	160	--	--	--	--	--	--
2-Chlorophenol	T	ug/l	5.8	410	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	T	ug/l	--	1600	--	--	--	--	--	--
2-Methylnaphthalene	T	ug/l	360	7.3	--	--	--	--	--	--
2-Methylphenol	T	ug/l	7600	16	--	--	--	--	--	--
2-Nitroaniline	T	ug/l	--	410	--	--	--	--	--	--
2-Nitrophenol	T	ug/l	--	810	--	--	--	--	--	--
3,3-Dichlorobenzidine	T	ug/l	--	410	--	--	--	--	--	--
3-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--
4-Bromophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--
4-Chloro-3-Methylphenol	T	ug/l	41	810	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--
4-Methylphenol	T	ug/l	510000	1.6	--	--	--	--	--	--
4-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--
4-Nitrophenol	T	ug/l	--	1600	--	--	--	--	--	--
Acenaphthene	T	ug/l	29	81	120	No	62	No	--	--
Acenaphthylene	T	ug/l	4.8	81	190	No	15	No	--	--
Acetophenone	T	ug/l	32	410	--	--	--	--	--	--
Anthracene	T	ug/l	12	81	0.66	Yes	0.53	Yes	0.035	Yes
Atrazine	T	ug/l	--	410	82	Yes	9	Yes	--	--
Benzaldehyde	T	ug/l	40	1600	180	No	14	Yes	--	--
Benzo(a)anthracene	T	ug/l	1.5	16	--	--	--	--	0.16	Yes
Benzo(a)pyrene	T	ug/l	3.2	16	--	--	--	--	0.016	Yes
Benzo(b)fluoranthene	T	ug/l	3.6	16	--	--	--	--	0.16	Yes
Benzo(g,h,i)perylene	T	ug/l	--	81	--	--	--	--	--	--
Benzo(k)fluoranthene	T	ug/l	0.62	16	--	--	--	--	1.6	No
bis(2-Chloroethoxy)methane	T	ug/l	3.8	160	--	--	--	--	--	--
bis(2-Chloroethyl)ether	T	ug/l	1.4	160	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	T	ug/l	290	810	76	Yes	17	Yes	1.9	Yes
Butyl benzyl phthalate	T	ug/l	1.3	160	--	--	--	--	--	--
Caprolactam	T	ug/l	2.9	810	--	--	--	--	--	--
Carbazole	T	ug/l	150	410	--	--	--	--	--	--
Chrysene	T	ug/l	3.3	41	--	--	--	--	16	No
Dibenzo(a,h)anthracene	T	ug/l	--	24	--	--	--	--	16	Yes
Dibenzofuran	T	ug/l	56	160	190	No	15	Yes	--	--
Diethyl phthalate	T	ug/l	32	160	--	--	--	--	--	--
Dimethyl phthalate	T	ug/l	--	160	--	--	--	--	--	--
Di-n-butyl phthalate	T	ug/l	5.5	410	--	--	--	--	--	--
Di-n-octyl phthalate	T	ug/l	--	810	--	--	--	--	--	--
Fluoranthene	T	ug/l	12	81	4.3	Yes	1.8	Yes	120	No
Fluorene	T	ug/l	83	81	59	Yes	16	Yes	4500	No
Hexachloro-1,3-butadiene	T	ug/l	--	410	--	--	--	--	--	--
Hexachlorobenzene	T	ug/l	--	41	--	--	--	--	--	--
Hexachlorocyclopentadiene	T	ug/l	--	1600	--	--	--	--	--	--
Hexachloroethane	T	ug/l	--	410	--	--	--	--	2.9	Yes
Indeno(1,2,3-cd)pyrene	T	ug/l	2	16	--	--	--	--	0.16	Yes
Isophorone	T	ug/l	19000	17	--	--	--	--	760	Yes
Naphthalene	T	ug/l	3600	3.6	510	Yes	68	Yes	--	--
Nitrobenzene	T	ug/l	--	81	15000	No	8500	No	530	No
N-Nitrosodi-n-propylamine	T	ug/l	--	41	--	--	--	--	--	--
N-Nitrosodiphenylamine	T	ug/l	14.5	81	--	--	--	--	--	--
p-Chloroaniline	T	ug/l	13	810	--	--	--	--	--	--
Pentachlorophenol	T	ug/l	1200	170	--	--	--	--	2.5	Yes
Phenanthrene	T	ug/l	69	81	46	Yes	3.7	Yes	--	--
Phenol	T	ug/l	4000	42	--	--	--	--	--	--
Pyrene	T	ug/l	10	81	--	--	--	--	3500	No
Volatile Organic Compounds										
1,1,1-Trichloroethane	T	ug/l	--	20	4900	No	390	No	--	--
1,1,2,2-Tetrachloroethane	T	ug/l	--	20	1800	No	140	No	3.2	Yes
1,1,2-trichloro-1,2,2-trifluoroethan	T	ug/l	--	20	--	--	--	--	--	--
1,1,2-Trichloroethane	T	ug/l	--	20	19000	No	4400	No	12	Yes
1,1-Dichloroethane	T	ug/l	3300	20	20000	No	2000	Yes	--	--
1,1-Dichloroethene	T	ug/l	10	20	3000	No	240	No	120	No
1,2,4-Trichlorobenzene	T	ug/l	--	20	370	No	72	No	--	--
1,2-Dibromo-3-chloropropane	T	ug/l	--	100	--	--	--	--	--	--
1,2-Dibromoethane	T	ug/l	--	20	--	--	--	--	--	--
1,2-Dichlorobenzene	T	ug/l	24	20	210	No	170	No	--	--
1,2-Dichloroethane	T	ug/l	58	20	25000	No	4500	No	23	Yes
1,2-Dichloropropane	T	ug/l	1.7	20	4800	No	380	No	--	--
1,3-Dichlorobenzene	T	ug/l	5.6	20	500	No	200	No	--	--
1,4-Dichlorobenzene	T	ug/l	23	20	1800	No	620	No	--	--
2-Butanone (MEK)	T	ug/l	2700	100	320000	No	26000	No	--	--
4-Methyl-2-Pentanone	T	ug/l	24000	100	46000	No	1400	Yes	--	--
Acetone	T	ug/l	4800	100	1500000	No	120000	No	--	--
Benzene	T	ug/l	540	0.5	3900	No	800	No	--	--
Bromodichloromethane	T	ug/l	--	20	10	Yes	1	Yes	14.9	Yes
Bromoform	T	ug/l	--	20	--	--	--	--	50	No
Bromomethane	T	ug/l	--	40	--	--	--	--	--	--
Carbon Disulfide	T	ug/l	33	40	200	No	20	Yes	--	--
Carbon Tetrachloride	T	ug/l	--	20	3500	No	280	No	1.4	Yes
CFC-11	T	ug/l	--	20	--	--	--	--	--	--
CFC-12	T	ug/l	--	40	--	--	--	--	--	--
Chlorobenzene	T	ug/l	660	20	990	No	79	Yes	4500	No
Chlorodibromomethane	T	ug/l	--	20	--	--	--	--	11	Yes
Chloroethane	T	ug/l	26	20	13000	No	1000	No	--	--
Chloroform	T	ug/l	0.65	20	1900	No	150	No	130	No
Chloromethane	T	ug/l	--	20	16000	No	1300	No	--	--
cis-1,2-Dichloroethene	T	ug/l	1100	20	--	--	--	--	--	--
cis-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--
Cyclohexane	T	ug/l	110	20	--	--	--	--	--	--
Dichloromethane	T	ug/l	6300	100	--	--	--	--	--	--
Ethylbenzene	T	ug/l	3400	0.5	--	--	--	--	--	--
Isopropylbenzene	T	ug/l	110	20	--	--	--	--	--	--
Methyl Acetate	T	ug/l	110	100	--	--	--	--	--	--
Methyl N-Butyl Ketone (2-Hexano	T	ug/l	--	100	12000	No	950	No	--	--
Methylcyclohexane	T	ug/l	170	20	--	--	--	--	--	--
Methyl-tert-butylether	T	ug/l	--	20	67000	No	5400	No	--	--
Styrene (Monomer)	T	ug/l	120	20	--	--	--	--	--	--
Tetrachloroethene	T	ug/l	680	20	--	--	--	--	--	--
Toluene	T	ug/l	11000	0.5	--	--	--	--	--	--
Total Xylenes	T	ug/l	19000	1	--	--	--	--	--	--
trans-1,2-Dichloroethene	T	ug/l	23	20	--	--	--	--	34000	No
trans-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--
Trichloroethene	T	ug/l	720	10	12000	No	940	No	25	Yes
Vinyl chloride	T	ug/l	420	10	8400	No	930	No	2	Yes

Notes:

[1] Maximum detect was used to screen criteria if available. If maximum detect not available (i.e., constituent not detected in any samples), the maximum non-detect was used.

-- = not available or not applicable

Attachment A
Screening of Maximum LCCS Groundwater Data Against Surface Water Benchmarks

					USEPA Ambient Water Quality Criteria							
Analyte	Fraction	Units	Maximum Detect, all wells[1]	Maximum Non-Detect, all wells[1]	Human Health Criteria, Water and Organism	Exceedance (Yes/No)	Human Health Criteria, Organism Only	Exceedance (Yes/No)	Acute Aquatic Life Criteria	Exceedance (Yes/No)	Chronic Aquatic Life Criteria	Exceedance (Yes/No)
Semivolatile Organic Compounds												
1,1-Biphenyl	T	ug/l	38	410	--	--	--	--	--	--	--	--
2,2-Oxybis(1-Chloropropane)	T	ug/l	0.32	160	200	No	4000	No	--	--	--	--
2,4,5-Trichlorophenol	T	ug/l	--	810	300	Yes	600	Yes	--	--	--	--
2,4,6-Trichlorophenol	T	ug/l	1.3	410	1.5	No	2.8	No	--	--	--	--
2,4-Dichlorophenol	T	ug/l	--	810	10	Yes	60	Yes	--	--	--	--
2,4-Dimethylphenol	T	ug/l	470	810	100	Yes	3000	No	--	--	--	--
2,4-Dinitrophenol	T	ug/l	--	1600	10	Yes	300	Yes	--	--	--	--
2,4-Dinitrotoluene	T	ug/l	--	81	0.049	Yes	1.7	Yes	--	--	--	--
2,6-Dinitrotoluene	T	ug/l	2.2	41	--	--	--	--	--	--	--	--
2-Chloronaphthalene	T	ug/l	3.1	160	800	No	1000	No	--	--	--	--
2-Chlorophenol	T	ug/l	5.8	410	30	No	800	No	--	--	--	--
2-Methyl-4,6-dinitrophenol	T	ug/l	--	1600	2	Yes	30	Yes	--	--	--	--
2-Methylnaphthalene	T	ug/l	360	7.3	--	--	--	--	--	--	--	--
2-Methylphenol	T	ug/l	7600	16	--	--	--	--	--	--	--	--
2-Nitroaniline	T	ug/l	--	410	--	--	--	--	--	--	--	--
2-Nitrophenol	T	ug/l	--	810	--	--	--	--	--	--	--	--
3,3-Dichlorobenzidine	T	ug/l	--	410	0.049	Yes	0.15	Yes	--	--	--	--
3-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--	--	--
4-Chloro-3-Methylphenol	T	ug/l	41	810	500	No	2000	No	--	--	--	--
4-Chlorophenyl phenyl ether	T	ug/l	--	410	--	--	--	--	--	--	--	--
4-Methylphenol	T	ug/l	510000	1.6	--	--	--	--	--	--	--	--
4-Nitroaniline	T	ug/l	--	810	--	--	--	--	--	--	--	--
4-Nitrophenol	T	ug/l	--	1600	--	--	--	--	--	--	--	--
Acenaphthene	T	ug/l	29	81	70	No	90	No	--	--	--	--
Acenaphthylene	T	ug/l	4.8	81	--	--	--	--	--	--	--	--
Acetophenone	T	ug/l	32	410	--	--	--	--	--	--	--	--
Anthracene	T	ug/l	12	81	300	No	400	No	--	--	--	--
Atrazine	T	ug/l	--	410	--	--	--	--	--	--	--	--
Benzaldehyde	T	ug/l	40	1600	--	--	--	--	--	--	--	--
Benzo(a)anthracene	T	ug/l	1.5	16	0.0012	Yes	0.0013	Yes	--	--	--	--
Benzo(a)pyrene	T	ug/l	3.2	16	0.00012	Yes	0.00013	Yes	--	--	--	--
Benzo(b)fluoranthene	T	ug/l	3.6	16	0.0012	Yes	0.0013	Yes	--	--	--	--
Benzo(g,h,i)perylene	T	ug/l	--	81	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	T	ug/l	0.62	16	0.012	Yes	0.013	Yes	--	--	--	--
bis(2-Chloroethoxy)methane	T	ug/l	3.8	160	--	--	--	--	--	--	--	--
bis(2-Chloroethyl)ether	T	ug/l	1.4	160	0.03	Yes	2.2	No	--	--	--	--
bis(2-Ethylhexyl)phthalate	T	ug/l	290	810	0.32	Yes	0.37	Yes	--	--	--	--
Butyl benzyl phthalate	T	ug/l	1.3	160	0.1	Yes	0.1	Yes	--	--	--	--
Caprolactam	T	ug/l	2.9	810	--	--	--	--	--	--	--	--
Carbazole	T	ug/l	150	410	--	--	--	--	--	--	--	--
Chrysene	T	ug/l	3.3	41	0.12	Yes	0.13	Yes	--	--	--	--
Dibenzo(a,h)anthracene	T	ug/l	--	24	0.00012	Yes	0.00013	Yes	--	--	--	--
Dibenzofuran	T	ug/l	56	160	--	--	--	--	--	--	--	--
Diethyl phthalate	T	ug/l	32	160	600	No	600	No	--	--	--	--
Dimethyl phthalate	T	ug/l	--	160	2000	No	2000	No	--	--	--	--
Di-n-butyl phthalate	T	ug/l	5.5	410	20	No	30	No	--	--	--	--
Di-n-octyl phthalate	T	ug/l	--	810	--	--	--	--	--	--	--	--
Fluoranthene	T	ug/l	12	81	20	No	20	No	--	--	--	--
Fluorene	T	ug/l	83	81	50	Yes	70	Yes	--	--	--	--
Hexachloro-1,3-butadiene	T	ug/l	--	410	0.01	Yes	0.01	Yes	--	--	--	--
Hexachlorobenzene	T	ug/l	--	41	0.000079	Yes	0.000079	Yes	--	--	--	--
Hexachlorocyclopentadiene	T	ug/l	--	1600	4	Yes	4	Yes	--	--	--	--
Hexachloroethane	T	ug/l	--	410	0.1	Yes	0.1	Yes	--	--	--	--
Indeno(1,2,3-cd)pyrene	T	ug/l	2	16	0.0012	Yes	0.0013	Yes	--	--	--	--
Isophorone	T	ug/l	19000	17	34	Yes	1800	Yes	--	--	--	--
Naphthalene	T	ug/l	3600	3.6	--	--	--	--	--	--	--	--
Nitrobenzene	T	ug/l	--	81		No	600	No	--	--	--	--
N-Nitrosodi-n-propylamine	T	ug/l	--	41	0.005	Yes	0.51	Yes	--	--	--	--
N-Nitrosodiphenylamine	T	ug/l	14.5	81	3.3	Yes	6	Yes	--	--	--	--
p-Chloroaniline	T	ug/l	13	810	--	--	--	--	--	--	--	--
Pentachlorophenol	T	ug/l	1200	170	0.03	Yes	0.04	Yes	19	Yes	15	Yes
Phenanthrene	T	ug/l	69	81	--	--	--	--	--	--	--	--
Phenol	T	ug/l	4000	42	4000	No	300000	No	--	--	--	--
Pyrene	T	ug/l	10	81	20	No	30	No	--	--	--	--
Volatile Organic Compounds												
1,1,1-Trichloroethane	T	ug/l	--	20	10000	No	200000	No	--	--	--	--
1,1,2,2-Tetrachloroethane	T	ug/l	--	20	0.2	Yes	3	Yes	--	--	--	--
1,1,2-trichloro-1,2,2-trifluoroethan	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	T	ug/l	--	20	0.55	Yes	8.9	Yes	--	--	--	--
1,1-Dichloroethane	T	ug/l	3300	20	--	--	--	--	--	--	--	--
1,1-Dichloroethene	T	ug/l	10	20	300	No	20000	No	--	--	--	--
1,2,4-Trichlorobenzene	T	ug/l	--	20	0.071	Yes	0.076	Yes	--	--	--	--
1,2-Dibromo-3-chloropropane	T	ug/l	--	100	--	--	--	--	--	--	--	--
1,2-Dibromoethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	T	ug/l	24	20	1000	No	3000	No	--	--	--	--
1,2-Dichloroethane	T	ug/l	58	20	9.9	Yes	650	No	--	--	--	--
1,2-Dichloropropane	T	ug/l	1.7	20	0.9	Yes	31	No	--	--	--	--
1,3-Dichlorobenzene	T	ug/l	5.6	20	7	No	10	No	--	--	--	--
1,4-Dichlorobenzene	T	ug/l	23	20	300	No	900	No	--	--	--	--
2-Butanone (MEK)	T	ug/l	2700	100	--	--	--	--	--	--	--	--
4-Methyl-2-Pentanone	T	ug/l	24000	100	--	--	--	--	--	--	--	--
Acetone	T	ug/l	4800	100	--	--	--	--	--	--	--	--
Benzene	T	ug/l	540	0.5	0.58	Yes	16	Yes	--	--	--	--
Bromodichloromethane	T	ug/l	--	20	0.95	Yes	27	No	--	--	--	--
Bromoform	T	ug/l	--	20	7	Yes	120	No	--	--	--	--
Bromomethane	T	ug/l	--	40	100	No	10000	No	--	--	--	--
Carbon Disulfide	T	ug/l	33	40	--	--	--	--	--	--	--	--
Carbon Tetrachloride	T	ug/l	--	20	0.4	Yes	5	Yes	--	--	--	--
CFC-11	T	ug/l	--	20	--	--	--	--	--	--	--	--
CFC-12	T	ug/l	--	40	--	--	--	--	--	--	--	--
Chlorobenzene	T	ug/l	660	20	100	Yes	800	No	--	--	--	--
Chlorodibromomethane	T	ug/l	--	20	0.8	Yes	21	No	--	--	--	--
Chloroethane	T	ug/l	26	20	--	--	--	--	--	--	--	--
Chloroform	T	ug/l	0.65	20	60	No	2000	No	--	--	--	--
Chloromethane	T	ug/l	--	20	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	T	ug/l	1100	20	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--	--	--
Cyclohexane	T	ug/l	110	20	--	--	--	--	--	--	--	--
Dichloromethane	T	ug/l	6300	100	20	Yes	1000	Yes	--	--	--	--
Ethylbenzene	T	ug/l	3400	0.5	68	Yes	130	Yes	--	--	--	--
Isopropylbenzene	T	ug/l	110	20	--	--	--	--	--	--	--	--
Methyl Acetate	T	ug/l	110	100	--	--	--	--	--	--	--	--
Methyl N-Butyl Ketone (2-Hexano	T	ug/l	--	100	--	--	--	--	--	--	--	--
Methylcyclohexane	T	ug/l	170	20	--	--	--	--	--	--	--	--
Methyl-tert-butylether	T	ug/l	--	20	--	--	--	--	--	--	--	--
Styrene (Monomer)	T	ug/l	120	20	--	--	--	--	--	--	--	--
Tetrachloroethene	T	ug/l	680	20	10	Yes	29	Yes	--	--	--	--
Toluene	T	ug/l	11000	0.5	57	Yes	520	Yes	--	--	--	--
Total Xylenes	T	ug/l	19000	1	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	T	ug/l	23	20	100	No	4000	No	--	--	--	--
trans-1,3-Dichloropropene	T	ug/l	--	20	--	--	--	--	--	--	--	--
Trichloroethene	T	ug/l	720	10	0.6	Yes	7	Yes	--	--	--	--
Vinyl chloride	T	ug/l	420	10	0.022	Yes	1.6	Yes	--	--	--	--

Notes:

[1] Maximum detect was used to screen criteria if available. If maximum detect not available (i.e., constituent not detected in any samples), the maximum non-detect was used.

-- = not available or not applicable

APPENDIX B

Standard Operating Procedures

ARCADIS

Infrastructure · Water · Environment · Buildings

Imagine the result

Surface Water Sampling

Rev. #: 4

Rev Date: January, 2015

I. Scope and Application

This Standard Operating Procedure (SOP) describes the collection of surface water samples using a peristaltic pump and/or grab surface water sampling methods. This SOP should be followed whenever collecting surface water samples.

This SOP may change depending on field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project Manager.

II. Personnel Qualifications

ARCADIS field personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, ARCADIS field personnel will be versed in the relevant SOPs and will possess the skills and experience necessary to successfully complete the desired field work. The project Health and Safety Plan (HASP) and other documents will identify any other training requirements, such as site-specific safety training or access control requirements.

III. Equipment List

The following equipment list identifies materials that may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required pending field conditions.

- Personal protective equipment (PPE) and other safety equipment, as required by the project HASP
- Project Quality Assurance Project Plan (QAPP)
- Sampling and Analysis Plan (SAP)
- Indelible ink pens
- Pole with polyethylene and/or stainless steel dipper, if applicable
- Disposable sample collection container, if applicable
- Appropriate sample containers, labels, and forms

- Decontamination supplies (see the SOP for Decontamination) including bucket, distilled or deionized water, brush, and cleansers appropriate for removing expected chemicals of concern

- Sample packing and shipping materials (see the SOP for Chain-of-Custody, Handling, Packing, and Shipping)

- Reel tape measure

- Water-quality (temperature/pH/specific conductivity/oxidation reduction potential/turbidity/dissolved oxygen) meter and flow-through measurement cell. Several brands may be used, including:
  - YSI 6-Series Multi-Parameter Instrument
  - Hydrolab Series 3 or Series 4a Multiprobe and Display
  - Horiba U-22 or U-52 Water Quality Monitoring System
  - HACH 2100 turbidity meter

- Peristaltic pump with appropriate power source

- Field filters, if applicable

- Teflon® tubing or Teflon®-lined polyethylene tubing of an appropriate size for the pump being used. For peristaltic pumps, dedicated Tygon® tubing (or other type as specified by the manufacturer) will also be used through the pump apparatus

- Nitrile gloves

- Extra batteries.

IV. Cautions

If heavy precipitation occurs and no cover over the sampling area can be erected, sampling must be discontinued until adequate cover is provided. Rain water could contaminate surface water samples.

Do not use permanent marker or felt-tip pens for labels on sample containers or sample coolers – use indelible ink. The permanent markers could introduce volatile constituents into the samples.

It may be necessary to field-filter some parameters (e.g., metals) prior to collection, depending on preservation, analytical method, and project quality objectives.

Store and/or stage empty and full sample containers and coolers out of direct sunlight.

Be careful not to over-tighten lids with Teflon® liners or septa (e.g., 40 mL vials). Over-tightening can cause the glass to shatter or impair the integrity of the Teflon® seal.

Use caution and appropriate cut-resistant gloves when tightening lids to 40 mL vials. These vials can break while tightening and can lacerate a hand. Amber vials (thinner glass) are more prone to breakage.

If thunder or lightning is present, discontinue sampling and take cover until 30 minutes have passed after the last occurrence of thunder or lighting.

The ability to safely access the surface water sampling locations should be verified prior to sampling.

Field activities will be performed in accordance with a project-specific HASP, a copy of which will be present on site during such activities.

Safety hazards associated with sampling surface water include fast-moving water, deep water, and steep slopes close to sampling sites. Extreme caution should be used when approaching sampling sites. Work will be performed in accordance with the project-specific HASP.

V. Procedure

Sampling Method

Surface water samples will be collected sequentially from downstream to upstream to prevent cross-contamination associated with sediment disturbance. Surface water samples will be collected prior to sediment sample collection.

Grab Sample Collection

Personnel conducting surface water sampling using grab sample collection techniques should perform the following:

1. Collect appropriate equipment, cleaned and decontaminated.

2. Obtain appropriate sampling containers.

3. Mobilize to the surface water sampling location in accordance with the work plan or SAP.

4. Measure the width of the stream at the sampling location. Stream width shall be measured from the edge of the wetted bank to the edge of wetted bank. Stream depth measurements shall also be taken if stream is wider than 5 ft. Stream depth shall be measured at 25, 50, and 75 percent of total stream width and then averaged across the stream.

   – If the stream is wider than 5 ft and deeper on average than 1 ft, the stream shall be sampled as a “large stream” until an adequate comparison of the results can be made.

   – If the stream is 5 ft wide or narrower and/or shallower than 1 ft of average depth, sampling shall be conducted as outlined in steps 6 through 10.

5. For larger streams, prior to sample collection, field parameters (temperature, pH, and conductivity) will be measured across the stream at 25, 50, and 75 percent of the stream width and recorded on field sampling sheets.

   – If field parameters (temperature, pH, and conductivity) vary by less than 10 percent, a grab sample will be collected.

   – If field parameters vary by more than 10 percent, a composite sample will be collected from discrete samples collected at the 25, 50, and 75 percent of the width locations. Approximately one third of the composite sample will be collected from each discrete sample location along the transect. Additionally, a single grab sample will be collected from one point along the same transect using standard methods for comparison to the composite results. After one event where a grab sample is collected (Peak flow 2014), a comparison will be made between the results. If total selenium and total cadmium concentrations for the two sampling methods are within 10 percent, composite sampling will be discontinued during subsequent events.

6. Collect the sample by directly lowering the selected sampling container into the water and allowing the bottle to partially fill with water. The sampler will hold the bottle immediately below the water surface and allow the bottle to fill with the sample. Field personnel will handle only the portions of the sample containers that do not come in contact with the sample to avoid contamination. Additionally, care will be taken to avoid exposing samples and sample containers to atmospheric inputs such as dirt or dust.

7. Measure water quality parameters in accordance with the SOP for Measuring Basic Water Quality Parameters.

8. Transfer surface water samples into laboratory-supplied sample containers to complete the scope described in the SAP. Avoid overfilling sample containers to prevent preservatives, if present, in sample container from being lost.

9. If field filtering is required, a peristaltic pump (or similar device) can be used to pump water through the filter for filling sample containers.

10. Handle samples in accordance with the SOP for Chain-of-Custody, Handling, Packing, and Shipping.

Sample Collection Using A Peristaltic Pump

Personnel conducting surface water sampling using peristaltic pump collection techniques should perform the following:

1. Collect surface water using a peristaltic pump if flow is slow and conventional sampling procedures are impossible without collecting excess suspended sediment in the sample. Note any observations such as color or odors and determine the depth of water. Record the information in the field log book or field log forms.

2. Be aware that contact with peristaltic pump apparatus (e.g., control knobs) can serve as a source of metals contamination in dissolved metals analyses. Operate pump controls with gloves that do not come into contact with the sample or with materials that contact the sample.

3. Prepare the stream tubing. Based on the distance to the pump location, cut the desired length of new Tygon® tubing with a clean utility knife.

4. Set up the pump. Cut approximately 1 foot of new C-Flex tubing from the roll. Remove the pump and controller from the transport case. Insert the C-Flex tubing into the pump head by releasing the lever on top of the pump head. Close the pump head on the tubing with the lever. Check to see that the tubing is aligned properly. Attach the pump head to the pump controller using the two set screws.

5. Attach the stream tubing and discharge tubing. Attach the stream tubing to the C-Flex using a new plastic connector. Attach a convenient length of Tygon® tubing to the C-Flex to serve as the discharge tubing. The discharge tubing may be attached

to a flow-through cell for various field measurements. Remove the flow-through cell prior to the collection of surface water samples for laboratory analysis.

6. Connect the power supply. Connect the power cord to the pump unit and the battery.

7. Start the pump. Set the head direction switch to send flow in the correct direction for the setup. Turn the pump switch to the ON position and adjust the flow rate with the dial to the desired flow rate.

8. Operate the pump at the desired flow rate.

9. Measure water quality parameters in accordance with the SOP for Measuring Basic Water Quality Parameters.

10. Collect surface water samples by diverting flow out of the unfiltered discharge tubing into the appropriate labeled sample container.

    – If a flow-through analytical cell is being used to measure field parameters, the flow-through cell should be disconnected after stabilization of the field indicator parameters and prior to surface water sample collection.
    – Under no circumstances should analytical samples be collected from the discharge of the flow-through cell. When the container is full, tightly screw on the cap.
    – Samples should be collected in the following order (if applicable): volatile organic compounds, total organic carbon, semivolatile organic compounds, metals and cyanide, and others (or other order as defined in the SAP).

11. Completion of sampling. At the completion of the sampling, turn off the pump and remove the tubing from the stream. Drain the tubing according to the project requirements. Remove the C-Flex tubing from the pump head. Discard all tubing and connectors according to project requirements.

12. Disconnect the power. Disconnect the power cord, disassemble the pump head from controller, and return equipment to the transport case.

13. Secure the well and properly dispose of PPE and disposable equipment.

14. Pack and store samples appropriately for transport to laboratory. Handle samples as described in the SOP for Chain-of-Custody, Handling, Packing, and Shipping.

15. Decontaminate the flow-through analytical cell, as appropriate.

VI. Waste Management

Investigation-derived waste (IDW) generated during the surface water sampling activities and disposable equipment will be transported for off-site disposal in accordance with the site-specific Waste Management Plan.

VII. Data Recording and Management

See the SOP for Field Documentation.

VIII. Quality Assurance

Sample quality will be achieved by complying with the procedures outlined in this SOP. Cross-contamination will be prevented by following the protocols described in the SOP for Field Equipment Decontamination. Field activities will be supervised by appropriately experienced field supervisors. Additional quality assurance information is presented in the project-specific QAPP.

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Measuring Basic Water Quality Parameters In-Situ

Rev. #: 2

Rev Date: January 2015

I. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures for calibrating and operating a water quality meter. Temperature, pH, specific conductivity, dissolved oxygen, ORP, and turbidity of groundwater and surface water will be measured in-situ with a combination water quality meter (Horiba U22 or equivalent). This SOP describes equipment, field procedures, materials, and documentation procedures. Groundwater quality parameters will be measured in-situ during the collection of groundwater quality samples. This SOP should be followed in conjunction with the *Groundwater Monitoring Well Sampling Procedures* SOP.

This is a standard (i.e., typically applicable) operating procedure which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the work plans or reports.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and CPR, as needed. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and possesses the required skills and experience necessary to successfully complete the desired field work.

III. Equipment List

The following materials, as required, shall be available during field measurement of water quality:

- Appropriate personal protective equipment as specified in the Site Health and Safety Plan
- Equipment decontamination supplies (See *Field Sampling Equipment Decontamination Procedures* SOP)
- Water quality meter, Horiba U22 or equivalent
- Replacement parts for the meter, including dissolved oxygen membrane
- Extra batteries

- Calibration/maintenance log(s)
- Calibration solutions
- Thermometer
- Distilled water
- Disposable plastic beakers
- Fine-end screw driver
- Field logbook
- Nitrile gloves.

IV. Cautions

Monitoring probes should not be placed in sample shipping containers to reduce the risk of contaminating a sample. A representative sub-sample should be used to measure the field water quality parameters.

Calibration standards must be stored properly. Check and replace all calibration standards per manufacturer suggestions to ensure accurate meter readings.

V. Health and Safety Considerations

Calibration solutions may contain hazardous chemicals. An MSDS should accompany all calibration solutions.

VI. Procedure

Calibration Procedures

The meter will be calibrated following the manufacturer's instructions. Calibration information will be recorded in the field logbook and a calibration log will be completed.

Operation Procedures

The meter will be operated following the manufacturer's instructions. Readings will be recorded in the field logbook.

Maintenance Procedures

The meter will be maintained according to the manufacturer's instructions. Maintenance information will be recorded in the field notebook. A replacement meter and probes will be available on-site or ready for overnight shipment, as necessary.

VII. Waste Management

Rinse water, PPE, and other residual material generated during the equipment decontamination will be placed in appropriate containers. Containerized waste and calibration solutions will be disposed of consistent with appropriate procedures as outlined in the *Handling and Storage of Investigation-Derived Waste* SOP.

VIII. Data Recording and Management

Field parameters will be recorded on the Low Flow Groundwater Monitoring Purge Log and in the field logbook for three-volume groundwater sampling in accordance with the specifications outlined in the *Quality Assurance Project Plan*.

All readings taken, calibration procedures, calibration checks, and adjustments will be documented in the field logbook. In addition, a calibration log will be completed for each day in which these procedures were conducted. These logs will be filed in the Laboratory Calibration Log Book.

All readings taken and adjustments made during calibrations and calibration checks will be recorded in the field notebook, along with the date and time at which the procedure was completed. The serial number of the meter and calibration solutions shall be recorded if applicable.

IX. Quality Assurance

Groundwater quality parameters should be measured prior to sample collection. If down-hole water quality meters are used, they will be decontaminated as specified in the *Field Sampling Equipment Decontamination Procedures* SOP (CalEPA, 1995).

X. References

California Environmental Protection Agency (CalEPA). 1995. *Representative Sampling of Groundwater for Hazardous Substances.* Guidance Manual for Ground Water Investigations. July 1995.

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Field Log Book Entries

Rev. #: 0

Rev Date: 11 August 2009

I. Scope and Application

This ARCADIS Standard Operating Procedure covers the entries needed in a field log book for environmental investigations.

This SOP does not address all of the entries that may be needed for a specific project, and does not address health and safety, equipment decontamination, field parameter measurements, sample preservation, chain-of-custody, or laboratory analysis. For direction on requirements in these areas, refer to other ARCADIS SOPs, the project work plans including the quality assurance project plan, sampling plan, and health and safety plan, as appropriate.

II. Personnel Qualifications

ARCADIS personnel participating in fieldwork and making entries into the field log book should have a minimum of one (1) year of field experience (or be under the supervision and accompanied in the field by someone who does) and current health and safety training including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and CPR, as needed. Field personnel will also be compliant with client-specific training requirements. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and posses the required skills and experience necessary to successfully complete the desired field work.

III. Equipment List

- Field Log Book
- Ball point (medium point) pen with blue or black ink (black preferred). A fine point Sharpie pen may be used if the ink does not bleed through the page and become visible on back side of the page. If weather conditions prevent the use of a pen, indicate so in the log and use an alternate writing instrument .
- Zip-lock baggie or other weather-proof container to protect the field log book from the elements.

IV. Cautions

All entries in the field log must be legible and archivable. Do not leave the field log book exposed to the elements or other conditions that might moisten the pages and smear/dissolve the entries. When not in the field, the log book should be stored in a location that is easily accessible to field crews.

V. Health and Safety Considerations

ARCADIS field personnel will be familiar and compliant with Client-specific health and safety requirements.

VI. Procedure

- Print legibly. Do not use cursive writing.
- The name of the project, project number and project location should be written in indelible ink on the outside of the field log book.
- On the inside of the front cover, write “If Found, Please Return to ARCADIS” and include the appropriate address and phone number, the name of the person to which the book is assigned, and the name of the project manager.
- Reserve the first page of the book for a Table of Contents.
- Reserve the last five (5) pages of the book for important contacts, notes, reminders, etc.
- Each day of field work, the following should be recorded in the field log book as applicable:

  a) Project Name

  b) Date and time arrived

  c) Work Site Location

  d) Names of people on-site related to the project including ARCADIS employees, visitors, subcontractor employees, agency personnel, client representative, etc.

  e) Describe the work to be performed briefly, and list the equipment on-site

  f) Indicate the health and safety (H&S) level to be used

  g) Record instrument calibrations and checks

  h) Record time and general content of H&S briefing

  i) Describe the weather conditions, including temperature, precipitation, and wind speed and direction

  j) List periodic time entries in the far left hand column of each page

  k) Minimize unused space on each page

- The tailgate meeting must be recorded in the log book and the tailgate form completed. If H&S monitoring is performed, record the time and results of initial and followup monitoring.

- Note factual observations including collection of QA/QC samples, delays, well damage, accidents, work plan deviations, instrument problems, and problem resolutions.

- Describe work performed and how documented such as photographs, sample core logs, water sampling logs, etc.

- Describe bases for field decisions including pertinent conversations with visitors, regulators, or project personnel.

- Note final instrument calibrations and checks.

- Sign the log book at the end of each day at a minimum. Draw a line to the end of the page to indicate no further entries on that page. Sign the bottom of each page if possible.

- If an entry to the log book is changed, strike out the deleted text or item with a single line such that the entry remains legible, and initial and date the change. Such changes should only be made by the same person that made the initial entry.

- Field log book entries must be made in the field at the site, not at a later time at a different location. Supplemental entries to the log book may be made at a later date. The supplemental entry must be clearly identified as such and the entry must be signed and dated as described in this SOP.

- Problems noted in the field log book must be brought to the attention of the project manager and task manager in a timely fashion. Problems may be reported in person, on the telephone, or in a written daily log form. If daily logs are prepared and you will not be able to personally give the daily log to the project manager, send the daily log via FAX or overnight courier to the project manager and task manager.

VII. Waste Management

Investigation-derived waste will be managed as described in the Investigation-Derived Waste Handling and Storage SOP. A drum/waste inventory should be maintained on a pre-designated page in the field log book.

VIII. Data Recording and Management

Each page of the field log book should be scanned for electronic/digital archiving at periodic intervals. This will ensure that copies of the field notes are available in the event the field book is lost or damaged, and that field data can be easily disseminated to others without the risk of physically sending the field log book. Field log books that are full should be archived with the project files, and readily retrievable.

IX. Quality Assurance

Be mindful that the field log book may be produced in court. All entries should be legible (as discussed above). Entries should also be in English, unless working in a country where English is not the predominant language or you are directed otherwise by the project manager.

X. References

Not Applicable

Infrastructure, environment, facilities

Imagine the result

Field Equipment Decontamination

Rev. #: 3

Rev Date: April 26, 2010

I. Scope and Application

Equipment decontamination is performed to ensure that sampling equipment that contacts a sample, or monitoring equipment that is brought into contact with environmental media to be sampled, is free from analytes of interest and/or constituents that would interfere with laboratory analysis for analytes of interest. Equipment must be cleaned prior to use for sampling or contact with environmental media to be sampled, and prior to shipment or storage. The effectiveness of the decontamination procedure should be verified by collecting and analyzing equipment blank samples.

The equipment cleaning procedures described herein includes pre-field, in the field, and post-field cleaning of sampling tools which will be conducted at an established equipment decontamination area (EDA) on site (as appropriate). Equipment that may require decontamination at a given site includes: soil sampling tools; groundwater, sediment, and surface-water sampling devices; water testing instruments; down-hole instruments; and other activity-specific sampling equipment. Non-disposable equipment will be cleaned before collecting each sample, between sampling events, and prior to leaving the site. Cleaning procedures for sampling equipment will be monitored by collecting equipment blank samples as specified in the applicable work plan or field sampling plan. Dedicated and/or disposable (not to be re-used) sampling equipment will not require decontamination.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired fieldwork. The project HASP and other documents will identify any other training requirements such as site specific safety training or access control requirements.

III. Equipment List

- health and safety equipment, as required in the site Health and Safety Plan (HASP)
- distilled water

- Non-phosphate detergent such as Alconox or, if sampling for phosphorus phosphorus-containing compounds, Luminox (or equivalent).
- tap water
- rinsate collection plastic containers
- DOT-approved waste shipping container(s), as specified in the work plan or field sampling plan (if decontamination waste is to be shipped for disposal)
- brushes
- large heavy-duty garbage bags
- spray bottles
- (Optional) – Isoprophyl alcohol (free of ketones) or methanol
- Ziploc-type bags
- plastic sheeting

IV. Cautions

Rinse equipment thoroughly and allow the equipment to dry before re-use or storage to prevent introducing solvent into sample medium. If manual drying of equipment is required, use clean lint-free material to wipe the equipment dry.

Store decontaminated equipment in a clean, dry environment. Do not store near combustion engine exhausts.

If equipment is damaged to the extent that decontamination is uncertain due to cracks or dents, the equipment should not be used and should be discarded or submitted for repair prior to use for sample collection.

A proper shipping determination will be performed by a DOT-trained individual for cleaning materials shipped by ARCADIS.

V. Health and Safety Considerations

Review the material safety data sheets (MSDS) for the cleaning materials used in decontamination. If solvent is used during decontamination, work in a well-ventilated area and stand upwind while applying solvent to equipment. Apply solvent in a manner that minimizes potential for exposure to workers. Follow health and safety procedures outlined in the HASP.

VI. Procedure

A designated area will be established to clean sampling equipment in the field prior to sample collection. Equipment cleaning areas will be set up within or adjacent to the specific work area, but not at a location exposed to combustion engine exhaust. Detergent solutions will be prepared in clean containers for use in equipment decontamination.

Cleaning Sampling Equipment

1. Wash the equipment/pump with potable water.

2. Wash with detergent solution (Alconox, Liquinox or equivalent) to remove all visible particulate matter and any residual oils or grease.

3. If equipment is very dirty, precleaning with a brush and tap water may be necessary.

4. (Optional) – Flush with isopropyl alcohol (free of ketones) or with methanol. This step is optional but should be considered when sampling in highly impacted media such as non-aqueous phase liquids or if equipment blanks from previous sampling events showed the potential for cross contamination of organics.

5. Rinse with distilled/deionized water.

Decontaminating Submersible Pumps

Submersible pumps may be used during well development, groundwater sampling, or other investigative activities. The pumps will be cleaned and flushed before and between uses. This cleaning process will consist of an external detergent solution wash and tap water rinse, a flush of detergent solution through the pump, followed by a flush of potable water through the pump. Flushing will be accomplished by using an appropriate container filled with detergent solution and another contained filled with potable water. The pump will run long enough to effectively flush the pump housing and hose (unless new, disposable hose is used). Caution should be exercised to avoid contact with the pump casing and water in the container while the pump is running (do not use metal drums or garbage cans) to avoid electric shock. Disconnect the pump from the power source before handling. The pump and hose should be placed on or in clean polyethylene sheeting to avoid contact with the ground surface.

VII. Waste Management

Equipment decontamination rinsate will be managed in conjunction with all other waste produced during the field sampling effort. Waste management procedures are outlined in the work plan or Waste Management Plan (WMP).

VIII. Data Recording and Management

Equipment cleaning and decontamination will be noted in the field notebook. Information will include the type of equipment cleaned, the decontamination location and any deviations from this SOP. Specific factors that should be noted include solvent used (if any), and source of water.

Any unusual field conditions should be noted if there is potential to impact the efficiency of the decontamination or subsequent sample collection.

An inventory of the solvents brought on site and used and removed from the site will be maintained in the files. Records will be maintained for any solvents used in decontamination, including lot number and expiration date.

Containers with decontamination fluids will be labeled.

IX. Quality Assurance

Equipment blanks should be collected to verify that the decontamination procedures are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring deionized water over the clean and dry tools and collecting the deionized water into appropriate sample containers. Equipment blanks should be analyzed for the same set of parameters that are performed on the field samples collected with the equipment that was cleaned. Equipment blanks are collected per equipment set, which represents all of the tools needed to collect a specific sample.

X. References

USEPA Region 9, Field Sampling Guidance #1230, Sampling Equipment Decontamination.

USEPA Region 1, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.

ARCADIS

Infrastructure · Water · Environment · Buildings

Imagine the result

Chain-of-Custody, Handling, Packing and Shipping

Rev. #: 2

Rev Date: March 6, 2009

I. Scope and Application

This Standard Operating Procedure (SOP) describes the chain-of-custody, handling, packing, and shipping procedures for the management of samples to decrease the potential for cross-contamination, tampering, mis-identification, and breakage, and to insure that samples are maintained in a controlled environment from the time of collection until receipt by the analytical laboratory.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, Department of Transportation (DOT) training, site supervisor training, and site-specific training, as needed. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired field work.

III. Equipment List

The following list provides materials that may be required for each project. Project documents and sample collection requirements should be reviewed prior to initiating field operations:

- indelible ink pens (black or blue);
- polyethylene bags (resealable-type);
- clear packing tape, strapping tape, duct tape;
- chain of custody;
- DOT shipping forms, as applicable;
- custody seals or tape;
- appropriate sample containers and labels;
- insulated coolers of adequate size for samples and sufficient ice to maintain ≤ 6°C during collection and transfer of samples;
- wet ice;
- cushioning and absorbent material (i.e., bubble wrap or bags);

- temperature blank;
- sample return shipping papers and addresses; and,
- field notebook.

IV. Cautions

Review project requirements and select appropriate supplies prior to field mobilization.

Insure that appropriate sample containers with applicable preservatives, coolers, and packing material have been supplied by the laboratory.

Understand the offsite transfer requirements for the facility at which samples are collected.

If overnight courier service is required schedule pick-up or know where the drop-off service center is located and the hours of operation. Prior to using air transportation, confirm air shipment is acceptable under DOT and International Air Transport Association (IATA) regulation

Schedule pick-up time for laboratory courier or know location of laboratory/service center and hours of operation.

Understand DOT and IATA shipping requirements and evaluate dangerous goods shipping regulations relative to the samples being collected (i.e. complete an ARCADIS shipping determination). Review the ARCADIS SOPs for shipping, packaging and labeling of dangerous goods. Potential samples requiring compliance with this DOT regulation include:

- Methanol preservation for Volatile Organic Compounds in soil samples
- Non-aqueous phase liquids (NAPL)

V. Health and Safety Considerations

Follow health and safety procedures outlined in the project/site Health and Safety Plan (HASP).

Use caution and appropriate cut resistant gloves when tightening lids to 40 mL vials. These vials can break while tightening and can lacerate hand. Amber vials (thinner glass) are more prone to breakage.

Some sample containers contain preservatives.

- The preservatives must be retained in the sample container and should in no instance be rinsed out.

- Preservatives may be corrosive and standard care should be exercised to reduce potential contact to personnel skin or clothing. Follow project safety procedures if spillage is observed.

- If sample container caps are broken discard the bottle. Do not use for sample collection.

VI. Procedure

Chain-of-Custody Procedures

1. Prior to collecting samples, complete the chain-of-custody record header information by filling in the project number, project name, and the name(s) of the sampling technician(s) and other relevant project information. Attachment 1 provides an example chain-of- custody record

2. Chain-of-custody information MUST be printed legibly using indelible ink (black or blue).

3. After sample collection, enter the individual sample information on the chain-of-custody:

   a. Sample Identification indicates the well number or soil location that the sample was collected from. Appropriate values for this field include well locations, grid points, or soil boring identification numbers (e.g., MW-3, X-20, SB-30). When the depth interval is included, the complete sample ID would be “SB-30 (0.5-1.0) where the depth interval is in feet. Please note it is very important that the use of hyphens in sample names and depth units (i.e., feet or inches) remain consistent for all samples entered on the chain-of-custody form. DO NOT use the apostrophe or quotes in the sample ID. Sample names may also use the abbreviations “FB,” “TB,” and “DUP” as prefixes or suffixes to indicate that the sample is a field blank, trip blank, or field duplicate, respectively. NOTE: The sample nomenclature may be dictated by the project database and require unique identification for each sample collected for the project. Consult the project data management plan for additional information regarding sample identification.

b. List the date of sample collection. The date format to be followed should be mm/dd/yy (e.g., 03/07/09) or mm/dd/yyyy (e.g. 03/07/2009).

c. List the time that the sample was collected. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

d. The composite field should be checked if the sample is a composite over a period of time or from several different locations and mixed prior to placing in sample containers.

e. The "Grab". field should be marked with an "X" if the sample was collected as an individual grab sample. (e.g. monitoring well sample or soil interval).

f. Any sample preservation should be noted.

g. The analytical parameters that the samples are being analyzed for should be written legibly on the diagonal lines. As much detail as possible should be presented to allow the analytical laboratory to properly analyze the samples. For example, polychlorinated biphenyl (PCB) analyses may be represented by entering "PCBs" or "Method 8082." Multiple methods and/or analytical parameters may be combined for each column (e.g., PCBs/VOCs/SVOCs or 8082/8260/8270). These columns should also be used to present project-specific parameter lists (e.g., Appendix IX+3 target analyte list. Each sample that requires a particular parameter analysis will be identified by placing the number of containers in the appropriate analytical parameter column. For metals in particular, indicate which metals are required.

h. Number of containers for each method requested. This information may be included under the parameter or as a total for the sample based on the chain of custody form used.

i. Note which samples should be used for site specific matrix spikes.

j. Indicate any special project requirements.

k. Indicate turnaround time required.

l. Provide contact name and phone number in the event that problems are encountered when samples are received at the laboratory.

m. If available attach the Laboratory Task Order or Work Authorization forms

n. The remarks field should be used to communicate special analytical requirements to the laboratory. These requirements may be on a per sample basis such as “extract and hold sample until notified,” or may be used to inform the laboratory of special reporting requirements for the entire sample delivery group (SDG). Reporting requirements that should be specified in the remarks column include: 1) turnaround time; 2) contact and address where data reports should be sent; 3) name of laboratory project manager; and 4) type of sample preservation used.

o. The “Relinquished By” field should contain the signature of the sampling technician who relinquished custody of the samples to the shipping courier or the analytical laboratory.

p. The “Date” field following the signature block indicates the date the samples were relinquished. The date format should be mm/dd/yyyy (e.g., 03/07/2005).

q. The “Time” field following the signature block indicates the time that the samples were relinquished. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

r. The “Received By” section is signed by sample courier or laboratory representative who received the samples from the sampling technician or it is signed upon laboratory receipt from the overnight courier service.

3. Complete as many chain-of-custody forms as necessary to properly document the collection and transfer of the samples to the analytical laboratory.

4. Upon completing the chain-of-custody forms, forward two copies to the analytical laboratory and retain one copy for the field records.

5. If electronic chain-of-custody forms are utilized, sign the form and make 1 copy for ARCADIS internal records and forward the original with the samples to the laboratory.

Handling Procedures

1. After completing the sample collection procedures, record the following information in the field notebook with indelible ink:

   - project number and site name;
   - sample identification code and other sample identification information, if appropriate;
   - sampling method;
   - date;
   - name of sampler(s);
   - time;
   - location (project reference);
   - location of field duplicates and both sample identifications;
   - locations that field QC samples were collected including equipment blanks, field blanks and additional sample volume for matrix spikes; and
   - any comments.

2. Complete the sample label with the following information in indelible ink:

   - sample type (e.g., surface water);
   - sample identification code and other sample identification information, if applicable;
   - analysis required;
   - date;
   - time sampled; and
   - initials of sampling personnel;

- sample matrix; and
- preservative added, if applicable.

3. Cover the label with clear packing tape to secure the label onto the container and to protect the label from liquid.

4. Confirm that all caps on the sample containers are secure and tightly closed.

5. In some instances it may be necessary to wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. For some projects individual custody seals may be required. Custody seal evidence tape may be placed on the shipping container or they may be placed on each sample container such that the cooler or cap cannot be opened without breaking the custody seal. The custody seal should be initialed and dated prior to relinquishing the samples.

Packing Procedures

Following collection, samples must be placed on wet ice to initiate cooling to < 6°C immediately. Retain samples on ice until ready to pack for shipment to the laboratory.

1. Secure the outside and inside of the drain plug at the bottom of the cooler being used for sample transport with "Duct" tape.

2. Place a new large heavy duty plastic garbage bag inside each cooler

3. Place each sample bottle wrapped in bubble wrap inside the garbage bag. VOC vials may be grouped by sample in individual resealable plastic bags). If a cooler temperature blank is supplied by the laboratory, it should be packaged following the same procedures as the samples. If the laboratory did not include a temperature blank, do not add one. Place 1 to 2 inches of cushioning material (i.e., vermiculite) at the bottom of the cooler.

4. Place the sealed sample containers upright in the cooler.

5. Package ice in large resealable plastic bags and place inside the large garbage bag in the cooler. Samples placed on ice will be cooled to and maintained at a temperature of approximately ≤ 6°C.

6. Fill the remaining space in the cooler with cushioning material such as bubble wrap. The cooler must be securely packed and cushioned in an upright position and be surrounded (Note: to comply with 49 CFR 173.4, filled cooler must not exceed 64 pounds).

7. Place the completed chain-of-custody record(s) in a large resealable bag and tape the bag to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with packing tape.

9. Wrap strapping tape around both ends of the cooler.

10. Mark the cooler on the outside with the following information: shipping address, return address, “Fragile, Handle with Care” labels on the top and on one side, and arrows indicating “This Side Up” on two adjacent sides.

11. Place custody seal evidence tape over front right and back left of the cooler lid, initial and date, then cover with clear plastic tape.

Note: Procedure numbers 2, 3, 5, and 6 may be modified in cases where laboratories provide customized shipping coolers. These cooler types are designed so the sample bottles and ice packs fit snugly within preformed styrofoam cushioning and insulating packing material.

Shipping Procedures

1. All samples will be delivered by an express carrier within 48 hours of sample collection. Alternatively, samples may be delivered directly to the laboratory or laboratory service center or a laboratory courier may be used for sample pickup.

2. If parameters with short holding times are required (e.g., VOCs [EnCore™ Sampler], nitrate, nitrite, ortho-phosphate and BOD), sampling personnel will take precautions to ship or deliver samples to the laboratory so that the holding times will not be exceeded.

3. Samples must be maintained at ≤ 6°C until shipment and through receipt at the laboratory

4. All shipments must be in accordance with DOT regulations and ARCADIS dangerous goods shipping SOPs.

5. When the samples are received by the laboratory, laboratory personnel will complete the chain-of-custody by recording the date and time of receipt of samples, measuring and recording the internal temperature of the shipping container, and checking the sample identification numbers on the containers to ensure they correspond with the chain-of-custody forms.

Any deviations between the chain-of-custody and the sample containers, broken containers, or temperature excursions will be communicated to ARCADIS immediately by the laboratory.

VII. Waste Management

Not applicable

VIII. Data Recording and Management

Chain-of-custody records will be transmitted to the ARCADIS PM or designee at the end of each day unless otherwise directed by the ARCADIS PM. The sampling team leader retains copies of the chain-of-custody forms for filing in . the project file. Record retention shall be in accordance with project requirements.

IX. Quality Assurance

Chain-of-custody forms will be legibly completed in accordance with the applicable project documents such as Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), Work Plan, or other project guidance documents. A copy of the completed chain-of-custody form will be sent to the ARCADIS Project Manager or designee for review.

X. References

Not Applicable

Attachment 1

ARCADIS
Infrastructure, environment, facilities

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:

Contact & Company Name:	Telephone:
Address:	Fax:
City State Zip	E-mail Address:
Project Name/Location (City, State):	Project #:
Sampler's Printed Name:	Sampler's Signature:

Preservative							
Filtered (✓)							
# of Containers							
Container Information							

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: ________
G. Other: ________
H. Other: ________

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other: ________
10. Other: ________

Matrix Key:
SO - Soil SE - Sediment NL - NAPL/Oil
W - Water SL - Sludge SW - Sample Wipe
T - Tissue A - Air Other: ________

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix								REMARKS

Special Instructions/Comments:

☐ **Special QA/QC Instructions(✓):**

Laboratory Information and Receipt		Relinquished By	Received By	Relinquished By	Laboratory Received By
Lab Name:	Cooler Custody Seal (✓)	Printed Name:	Printed Name:	Printed Name:	Printed Name:
☐ Cooler packed with ice (✓)	☐ Intact ☐ Not Intact	Signature:	Signature:	Signature:	Signature:
Specify Turnaround Requirements:	Sample Receipt:	Firm:	Firm/Courier:	Firm/Courier:	Firm:
Shipping Tracking #:	Condition/Cooler Temp: ________	Date/Time:	Date/Time:	Date/Time:	Date/Time:

20730826 CofC AR Form 01.12.2007 **Distribution:** **WHITE – Laboratory returns with results** **YELLOW – Lab copy** **PINK – Retained by BBL**

Arcadis U.S., Inc.

200 South Michigan Avenue

Suite 2000

Chicago, Illinois 60604

Tel 312 917 1000

Fax 312 917 1572

www.arcadis.com